

PUBLIC WORKS

June
1953

CITY, COUNTY AND STATE

Special Section on
**PATCHING
PAVEMENTS
PROPERLY**

**sofiltration—An Up-To-
Date Summary**

**Studies of Refuse
Collection Practices**

**Timber Bridges for
Highway Service**

**What's Next in
Mosquito Control Methods**

**Fluoridation Equipment
and Facilities**

**Belt Conveyors
Handle Sewage Sludge**



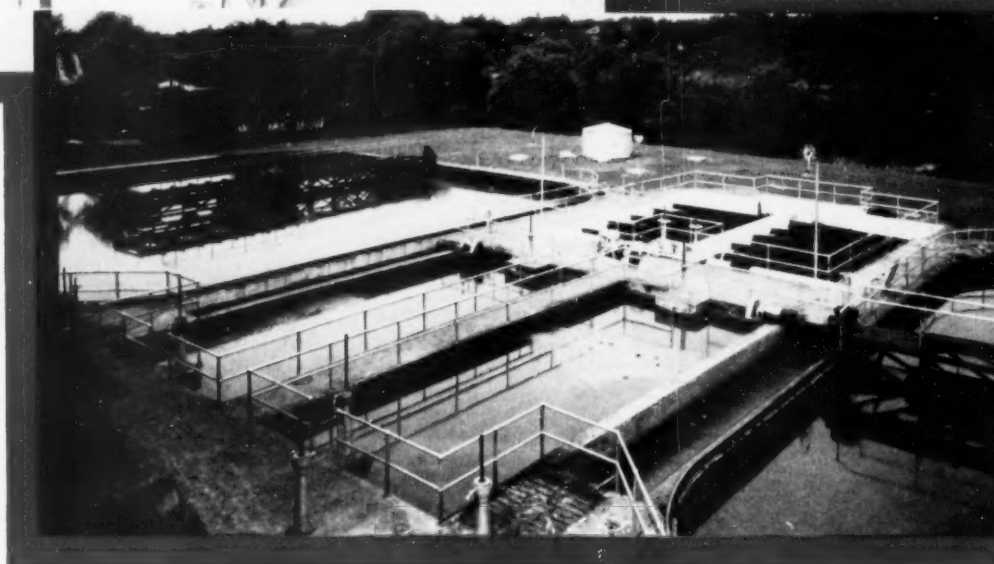
Robert L. Andersen, Village Engineer and Superintendent of Public Works of Winnetka, Ill., is outstanding in public service. See page 24.



1936

1953

Upper And Lower Photos Show
New Brunswick, N. J. Sewage
Treatment Plant Just After
Construction And Now.



17 YEARS' SERVICE PROVES ECONOMY OF **POZZOLITH CONCRETE**

"Your cement-dispersing agent, Pozzolith, has done a good job at our plant" writes S. Seid, Supervisor, City of New Brunswick, N. J., Dept. of Public Works.

Inspection reports from many plants like this show that after 15 and 20 years of service, Pozzolith Concrete is free of scaling and other disintegration, even at the water line.

In addition to producing great durability,

Pozzolith provides concrete with reduced permeability — *at lower cost than by any other means*. This is because Pozzolith disperses cement, reduces unit water content — water required per cubic yard of concrete — and entrains the optimum amount of air.

Full information on Pozzolith and "see-for-yourself" demonstration kit supplied on request . . . without cost or obligation.

The

MASTER



BUILDERS

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CLEVELAND 3, OHIO

Subsidiary of American-Marietta Company

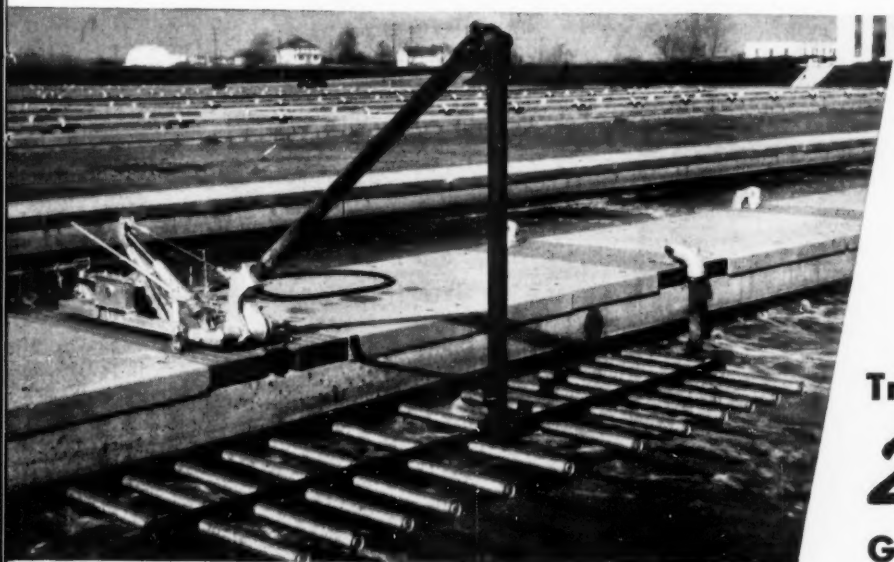
TORONTO, ONTARIO

Chicago

SWING DIFFUSERS

Proven

IN 261 PLANTS



Treating More Than
2½ Billion
Gallons Per Day...

COLUMBUS, OHIO

Replacement of plates with Chicago Swing Diffusers made possible the efficient aeration of 17,000,000 more gallons per day (48,000,000 to 65,000,000). This was accomplished without adding to existing tanks or blowers.

PHOENIX, ARIZONA

Installation of Chicago wide-band aeration in place of existing aeration system practically doubled aeration capacity without additional tanks. (10,000,000 to 19,210,000).

Over the past six years the engineers for these major plants have specified Chicago Swing Diffusers . . .

NEW YORK CITY
Hunts Point Plant
Rockaway Plant
Owl's Head Plant

LOS ANGELES, CALIFORNIA
Hyperion Plant

BOSTON, MASS.
Nut Island Plant

PHILADELPHIA, PA.
Southwest Plant
Northeast Plant

SAN ANTONIO, TEXAS

Complete list of installations and consulting engineers available upon request.

Leading consulting and design engineers and plant operators agree that Chicago Swing Diffuser Systems offer important exclusive advantages for new plants. And, in addition, they provide a logical solution where existing aeration systems are inadequate. Here are a few reasons why . . .

ACCESSIBILITY . . . Individual swing units are easily raised for inspection and diffuser cleaning.

CONTINUOUS PERFORMANCE . . . Only with Chicago Swing Diffusers can uninterrupted operation be assured without costly stand-by aeration tanks.

ECONOMICAL OPERATION . . . Lowest cost simplified cleaning restores new tube performance, permitting maintenance of lower blower pressures.

EFFICIENT AERATION . . . Wide-band air diffusion provides greater contact volume of diffused air with tank liquor and the longest contact period. No unaerated center core.

Complete operating histories and test data on Chicago Diffuser Systems are available for your review.

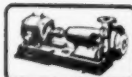


CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

622 DIVERSEY PARKWAY

Flush Klean, Scrub-Peller, Plunger,
Horizontal and Vertical Non-Clogs
Water Seal Pumping Units, Samplers



CHICAGO 14, ILLINOIS

Swing Diffusers, Stationary Diffusers,
Mechanical Aerators, Combination
Aerator-Clarifiers, Comminutors.

Look at the record!

Winnebago County, Wisconsin, owns five Cat* Diesel Motor Graders and five competitive graders of comparable horsepower. These operating costs are on public record. Study the figures—they tell their own story, one that can be duplicated across the country. They're a good reason to see your Caterpillar Dealer for further information and a demonstration!

Caterpillar Tractor Co., Peoria, Illinois.

1951 repair costs...Winnebago County, Wisconsin

COMPETITIVE GRADERS

Model	Year Purchased	Repairs	Hours
A	1946	\$ 555.65	1,770.5
B	1947	1,744.76	1,769.5
C	1948	1,030.86	2,168.5
D	1949	663.42	1,932.5
E	Sept. '51	112.90	515.5
		<u>\$4,107.59</u>	<u>8,156.5</u>

Average per unit \$821.52
 Average per hour50
 Average age 3.66 years

CATERPILLAR DIESEL MOTOR GRADERS

Model	Year Purchased	Repairs	Hours
No. 12	1945	\$1,090.64	1,456.5
No. 12	1946	525.81	1,744.5
No. 12	1948	244.70	1,972.0
No. 112	1948	254.16	2,325.5
No. 112	1949	45.37	559.0
		<u>\$2,160.68</u>	<u>8,057.5</u>

Average per unit \$432.13
 Average per hour27
 Average age 4.8 years



Mixing blacktop southwest of Oshkosh, Wisconsin—a Caterpillar Diesel No. 12 Motor Grader, one of five Cat Graders owned by Winnebago County.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—R)

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 WILL DEMONSTRATE**

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PUBLIC WORKS MAGAZINE



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The 1953 volume of Public Works will be available on microfilm through University
Microfilm, 313 N. First St., Ann Arbor, Mich.

**THE MOST USEFUL ENGINEERING MAGAZINE
FOR CITIES, COUNTIES AND STATES**



What Do American Highway Officials Think of RUBBER ROADS?

A recent independent survey of American Highway Officials in regard to their attitudes toward rubber roads produced some impressive and significant responses.

Citing "rubber" as the most important new development in highway surfacing, city and town highway engineers pointed to "longer wear and life" as the chief advantage of rubber-asphalt roads, and 72% of them said that if funds were available, they would recommend the laying of a test rubber road in their locality.

Most impressive of all — *one-third* of all the highway officials are already convinced that the addition of rubber to asphalt paving will become a *standard* method of highway construction.

To *prove* the value of rubber roads in stretching the highway dollar, highway engineers from coast to coast are laying test strips of natural rubber roads this year in their communities. It is possible to "pave a block" with natural rubber-asphalt top surfacing for an added cost of less than \$500 for the average block. Such tests will prove to the local highway engineer just how much he can save on repairs and maintenance over a period of years by adding natural rubber powder to the asphalt top surfacing of his roads.

Write for a copy of this interesting survey showing in detail what the American highway engineer thinks of rubber roads.

Natural Rubber Bureau

1631 K Street, N. W., Washington 6, D. C.

Natural Rubber Bureau Research Laboratory, Rosslyn, Virginia



Natural Rubber Bureau

1631 K Street, N. W., Washington 6, D. C.

Please send me . . .

- ☐ Copy of new survey report on rubber roads.
- ☐ Copy of booklet "Stretching Highway Dollars with Rubber Roads."
- ☐ Information about laying a test road of natural rubber-asphalt paving.

Name

Title

Street

City State

THE EDITOR'S POINT OF VIEW



Many Factors in Engineering Change with the Years

SYMBOLIC of the changes that take place in engineering is that which has occurred in the composition of refuse over the past two decades. Twenty years ago refuse consisted of 65 percent garbage and 35 percent rubbish, with a moisture content around 55 percent. Now the proportions of rubbish and garbage have about been reversed, and moisture contents are down around 40 percent. In other fields, there is some indication that domestic sewages are becoming weaker in organic content; and the amount of traffic on our highways has increased to an extent that bewilders some of us occasional drivers.

Engineering is never static and we who practice engineering cannot be static either, or the world and other professions will pass by us with scarcely a nod. We hope this concept and realization of changes in engineering will be passed on to to-day's engineering students. If not, our engineering schools will have failed in an important job.

Toll Roads Seem to Be Here to Stay Whether We Like Them or Not

TOLL roads are with us, apparently whether we like the idea or not. The present ones have been built through congested areas and they have solved a serious traffic problem quickly and efficiently. They are attracting sufficient traffic to pay the cost of operation and to pay the carrying charges on the bonds. What effect they will have on the free highway system remains to be seen.

Mr. John Q. Public, who is supporting these toll roads, usually doesn't realize how much gas tax he is paying. Take the New Jersey Turnpike as an example. The entire length of the road is 118 miles and the toll for a passenger car to cover that entire distance is \$1.75 which figures 1.48 cents per mile. If a car travels 12 miles on a gallon of gasoline the toll cost per gallon is 17.76 cents, which is a gas tax of that amount in addition to the State and Federal gas tax. Most cars will do better than 12 miles per gallon so the toll gas tax will be still higher.

Apparently people are willing to pay gas taxes

much above the present level if adequate highway facilities are provided. Toll roads have the advantage of presenting a finished project before payment is demanded, whereas a campaign for increased gas taxes must be based on promises for the future. However it may be done, money must be found to finance additional highway work to care for the increased demands of more and more traffic.

That "Better Maintenance Equipment Needed" Editorial

ON this page there appeared in our April issue an editorial "Better Maintenance Equipment Needed," which roiled the temper of at least one reader—the sales manager of Tarrant Mfg. Co. He points out that his firm does make "small portable dryers with reasonably high output"; and that their "Flash-Flame aggregate and material dryer is capable of drying up to 10 tons of sand or 15 tons of stone per hour and is being used to supply additional dry aggregate for small bituminous mixers." Most of all, he reminds us that the "Scotchman salt spreader is especially designed for the application of clear salt."

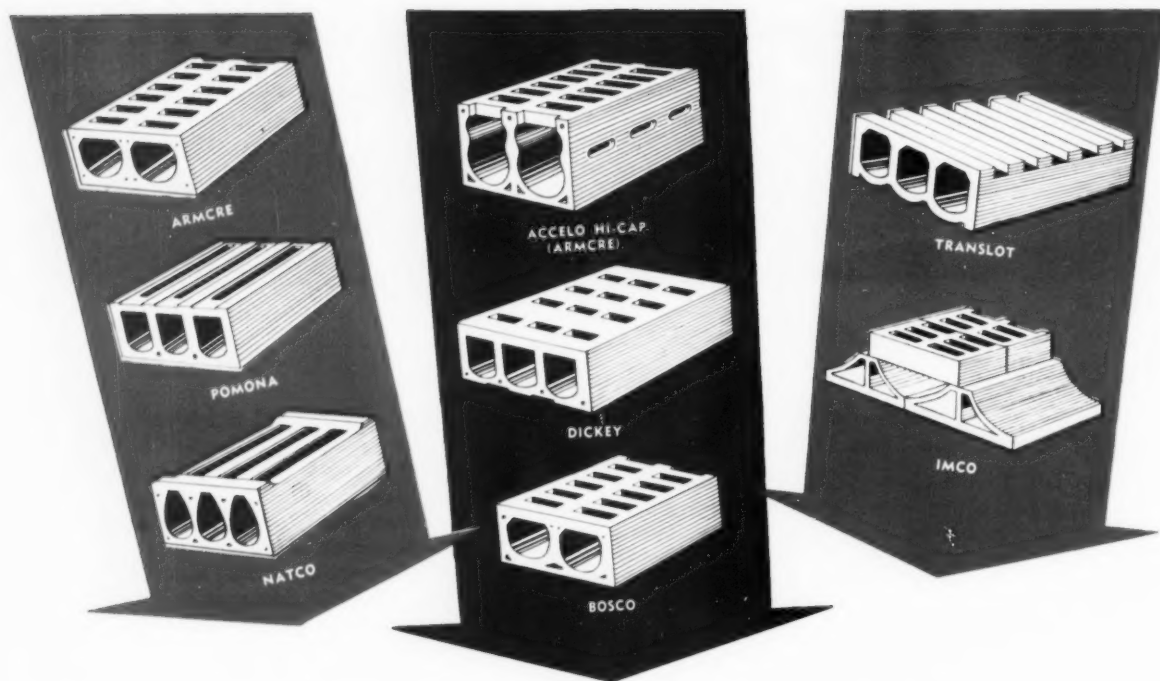
It was not our intention to say anything that might hurt the feelings of anyone; and if we have done so, we are sorry. Rather it was our intention to emphasize the great need on the part of our cities, counties and states for the use of still more equipment if to-day's problems are to be met at a reasonable cost.

Too Big Chunks Aren't Easily Digestible

POSSIBLY we are presenting our highway problem and highway needs in a chunk too big to be easily digested. Perhaps we should talk of millions rather than billions.

Sam Hadden of Indiana said recently that if you wanted to sell a man a dozen eggs, you didn't cook them all and put them in front of him. If you did he wouldn't eat them. However, if you present them to him one at a time he will not only eat them but pay for them too.

Breaking the big problem into smaller pieces for presentation to the public may help to get the entire idea across. At least it will do no harm to try.



For better trickling filter results

USE TFFI INSTITUTE SPECIFICATION UNDERDRAINS

These are scientifically designed *vitrified clay filter bottom blocks* that insure trouble-free operation over the life of the filter. They provide the right ventilation and free discharge of effluent. Even after years of operation there is quick drainage and no clogging. Unskilled labor can lay these light-weight blocks easily.

Use them to insure best results from your next trickling filter. Give it a *specification floor of TFFI vitrified clay filter bottom blocks*. Get full engineering data by writing any member of the Institute today.



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Kansas City 6, Mo.

Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

Bowerston Sho'e Co.
Bowerston, Ohio

Here's The Payoff

The Orlando, Fla., sewage treatment plant is now treating just under 4 mgd. Raw sewage has a BOD of 176 ppm; the effluent 10.6 ppm. Suspended solids in the raw are 134 ppm; in the final effluent 6.7 ppm. BOD loading on the filters is 1.8 lbs. per cu. yd.; recirculation is 1.25:1. The gas produced by the plant is ample to generate 1800 kw, which is ample for all power purposes. For the plant layout, see page 65 of this issue.



Orlando, Florida Biofiltration System
Smith & Gillespie, Consulting Engineers
Ivy H. Smith Co., Contractors
A. B. Herdon, City Engineer

Thousands use our Readers' Service card to keep up to date . . . do you?

High Speed ground crew

**Mows four times faster with
International Super-A's**



MOWIN' 'EM DOWN. The hard-working Super-A is typical of the International line of wheel and crawler tractors. Among them, there's sure to be an International that can save money and do more work per day on any job you can name.

The main airline field serving Savannah, Georgia, covers 2,800 acres of which 1,500 must be mowed.

It used to take a month to cut it once-over, mowing with low-speed units. Then the Savannah Airport Commission put two International Super-A tractors to work, and they do the same job in one quick week.

"We bought these Internationals to reduce costs, and get a better-kept field with less manpower," says Airport Manager, Frank Leahardy.

Fast, handy International wheel tractors bring the benefits of more efficient operations to many municipal jobs . . . mowing down summer grass, sweeping up autumn leaves, dozing off winter snow . . . anything that calls for rugged, reliable "Power on Wheels".

Let your International Industrial Distributor give you the details!

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

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**POWER
THAT
PAYS**

Dallas Prefers Concrete Pressure Pipe



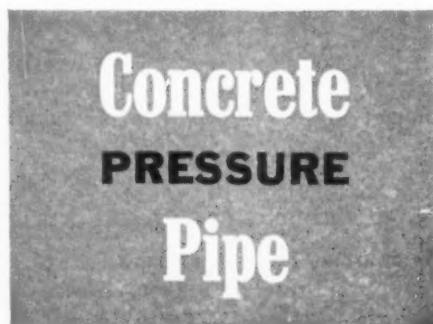
In 1915 Dallas installed the first concrete pressure pipe in its water supply system. Since 1945 several additional miles have been built, and at present a new 23,300 ft. line is under construction.

Dallas engineers prefer concrete pressure pipe because it is easy and economical to

install—it requires little or no maintenance—and it has a permanent high carrying capacity. Another important reason for its selection is that water pumped through concrete pressure pipe stays clean—thereby minimizing any odor, taste, and color difficulties.

Like Dallas, many other cities, large and small, are specifying concrete pressure pipe for their water systems. If your city is planning additional water lines, or replacements for old lines, be sure to investigate the advantages of concrete pressure pipe.

Water for Generations to come



**AMERICAN CONCRETE
PRESSURE PIPE
ASSOCIATION**

228 North LaSalle Street
Chicago 1, Illinois

Now's the time to mail this month's Readers' Service card.

ONE Truck and Only ONE Man Handle 15 to 25 Loads of Trash and Rubbish Like This Daily . . .



What you see above is a truck-mounted Dempster-Dumpster picking-up, hauling and then dumping a 10 cu. yd. Dempster-Dumpster Detachable Container. Instead of a conventional truck with loading crew, you have a truck-mounted Dempster-Dumpster with only one man, the driver, handling scores of detachable containers. These big containers replace hundreds of unsanitary cans, crates, barrels, etc. at hospitals, schools, market, housing and apartment areas. And your city has no expense of loading. The loading is done for you by the people who create the rubbish. The Dempster-Dumpster services the containers on pre-arranged schedule—handling 15 to 25 daily, one after another, with one man.

The Dempster-Dumpster is mounted on any make truck chassis of suitable size. One Dempster-Dumpster, operated by only one man,

the truck driver, by means of hydraulic controls in cab, does the work of 3 to 5 conventional trucks and crews. This Dempster-Dumpster System eliminates trucks and crews standing idle . . . eliminates re-handling of trash and rubbish . . . increases efficiency and sanitation.

Dozens of average size cities like Pensacola, Tuscaloosa and Lexington,

Ky. as well as large cities like Baltimore, Richmond, New York and Pittsburgh have installed the Dempster-Dumpster System. This modern method is saving each thousands of dollars annually plus eliminating rat-infested, unsanitary conditions. Complete information may be obtained by writing direct to Dempster Brothers, Inc.—exclusive manufacturers.



One Dempster-Dumpster Handles All Containers . . . All Sizes . . . All Designs



DEMPSTER BROTHERS, 963 Dempster Bldg., Knoxville 17, Tennessee

Need more facts about advertised products? Mail your Readers' Service card now.

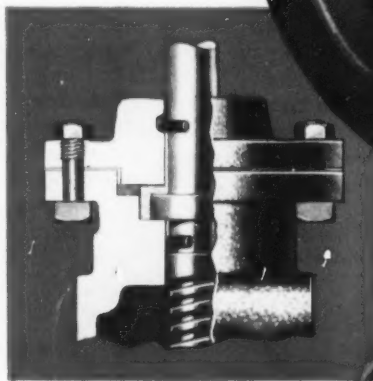
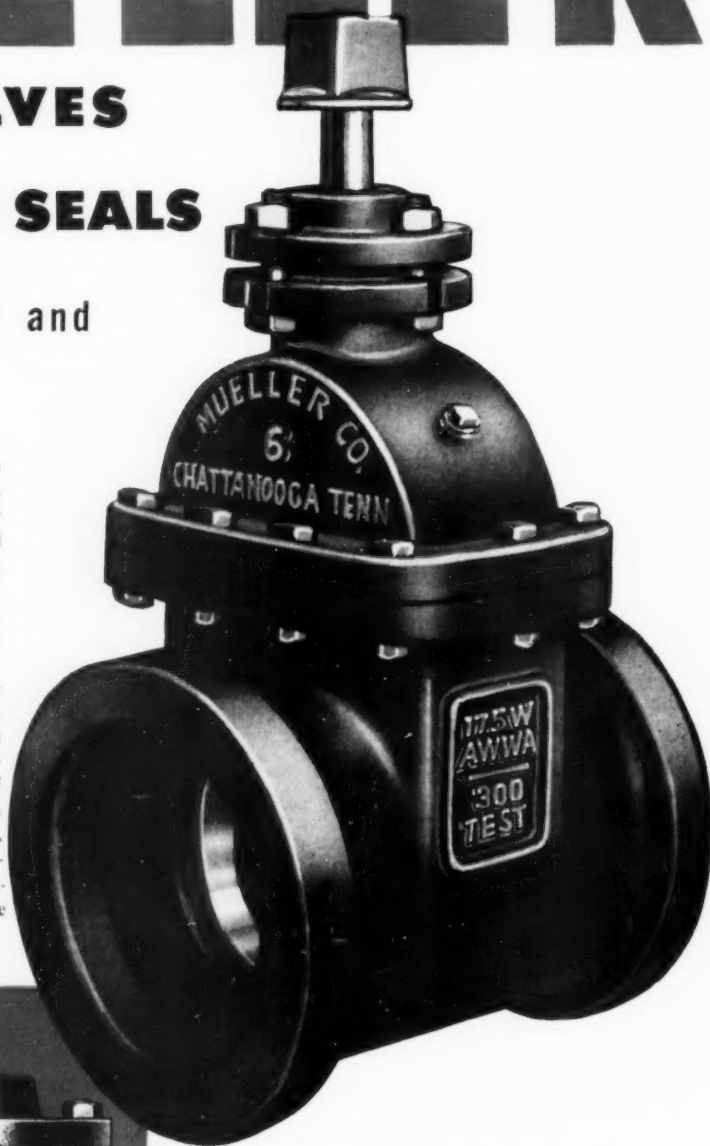
MUELLER

GATE VALVES

with "O" RING SEALS

eliminates repacking and
tightening!

Maintenance is reduced to a minimum on Mueller Gate Valves with "O" Ring Seals replacing conventional packing. The lower "O" ring is the pressure seal and is located below the thrust collar. The upper "O" ring is the dirt seal and is located above the thrust collar. The space between the "O" rings is filled with a special lubricant to permanently lubricate the thrust collar and "O" rings each time the valve is operated. "O" rings have proved to be highly effective and do not deteriorate - assuring a long-life pressure seal. Mueller Gate Valves are fully bronze mounted and all working parts are made of special high grade bronze for maximum corrosion resistance. "O" Ring Seals furnished, when specified, at same price as conventionally packed valves. Meet AWWA specifications. Contact your Mueller representative or write direct for details.



"O" Ring Seal construction showing lower "O" ring compressed when gate valve is fully open and under pressure.

Unit gate assembly showing exclusive "four point contact" wedging mechanism. (Can be furnished with all bronze disc and wedging mechanism when specified.)



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Got the angle . . .

for **BIG** volume pumping?

You get a new high in service from Fairbanks-Morse *Angleflow* Pumps. They're designed for BIG volume pumping against moderate heads — sizes range from 8 to 54 inches . . . capacities up to 80,000 GPM.

You can move big volumes of sewage or storm water too, with *low* operating and maintenance costs. These *Angleflow* Pumps, with their wide, unobstructed impeller and volute passages, are especially suitable for handling debris-filled water.

For information, see your local Fairbanks-Morse Pump Engineer . . . or write Fairbanks, Morse & Co., Chicago 5, Illinois.



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THE MODEL R with 5 Important Features

1. Solves your problem of seal coating.
2. Spread forward or reverse with control of material flow.
3. Adjustable width of spread.
4. Handles all types of aggregate from fine sand to crushed stone.
5. With world wide acceptance, the MODEL R is your best performer.



MODEL DD HI-WAY TAIL GATE SPREADER

And THE MODEL DD for All Purpose, All Weather

This unit clamps onto the tailgate of an ordinary dump body truck and the material is fed into the hopper by gravity—with no shoveling required! all year 'round performer; spreads sand, chips, etc. for seal coat work, as well as calcium chloride in the summer months; and sand, cinders, salt, and other types of material for ice control in the winter months.

Sold and serviced by leading dealers in U.S.A. and Canada. Write us today for free literature on all models, we manufacture.

HIGHWAY EQUIPMENT CO., Inc.
Cedar Rapids, Iowa

UP FRONT FOR ADEQUATE ROADS

BY

LEO J. RITTER, JR.

New York University



Soil-Cement—A recent issue of *Soil-Cement News*, published by the Portland Cement Association, reports that over 100 million square yards of soil-cement have now been built in the United States. By way of comparison, this is equivalent to a 20-foot road 8500 miles long. Considering that the first full-scale project utilizing this versatile combination was built in 1935, this is a remarkable record. The "News" also indicates that some progress is being made toward simplifying the procedure which must be followed in selecting the amount of cement to be used with a given soil; data for estimating the cement content of sandy soils by a simplified procedure are already available.

Sufficiency Ratings in Colorado—A law passed by the state legislature of Colorado in recent session requires cities and counties to submit annual road and street programs with projects listed on a priority basis. The sufficiency rating system which is being used by the state highway department must also be used by these agencies. Colorado is one state which is making some real progress in the modernization of its state highway program. The battle for highway modernization in Colorado is a tough one, because of difficult topographical and climatic conditions, and a general lack of sufficient funds for highway purposes. Incidentally, when the weather gets warm this summer I know I am going to wish I was in the perpetual snow and awe-inspiring peaks of the "high country" in Rocky Mountain National Park.

Signs of the Times—A recent study prepared for the Connecticut State Highway Department concerning the Boston Post Road indicates that traffic congestion is again reaching intolerable levels. This is the same

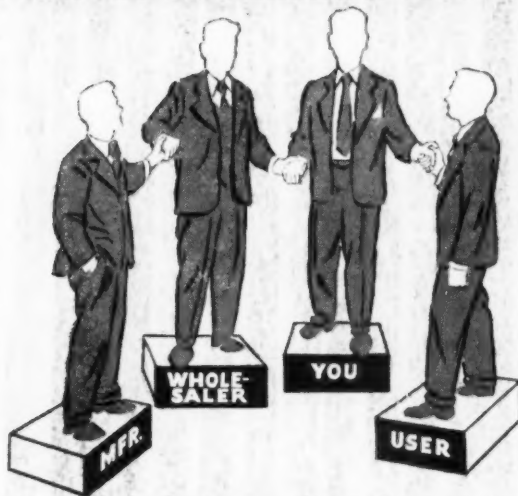
situation that existed in the 'thirties, when the Merritt Parkway was constructed to relieve the pressure on the Post Road. The Parkway is congested now, too, during periods of peak traffic demand, so that Connecticut must again give thought to a new route to ease congestion on the Post Road. It just goes to show that the highway problem is not a static one and that highway builders must keep abreast of the ever-changing situation.

'Tain't So—, says the Joint Highway Research Project of M.I.T. and the Massachusetts Department of Public Works. What ain't so? The big claims that have been published about a magical compound which could be incorporated into a wearing surface and keep it free from ice and snow even in extremely cold weather. Apparently this material, invented by one William Rademache of Germany, simply will not do what first reports claimed for it, and there is more than reasonable doubt that it will succeed at all. (Editor's Note: See *Public Works* for May, 1953, page 113).

One-Way Streets—The March-April issue of *California Highways and Public Works* carries an interesting article about the effectiveness of one-way streets in Sacramento. Among the conclusions reached as a result of a careful study are the following: (1) Traffic volume increased 14.0% on pairs of one-way streets as compared with the same streets when operated for two-way traffic; (2) Traffic speed during one-way operation increased 24.4% during peak hours with one-way operation; (3) the vehicle accident rate reduced an average of 61.9% on all streets converted from two-way to one-way. An interesting aspect of the study was the fact that on one of the streets converted to one-way operation the volume of retail business showed a greater increase than that shown in the area as a whole. This latter economic fact has lead local

(Continued on page 143)

THE WHOLESALE AND YOUR FUTURE



You and your wholesaler have a common interest; you two are the important links in the distribution chain that connects the producer with the user.

Much depends upon your combined operations, for each of you has an important function in maintaining the flow of manufactured goods from where they are

made to where they are eventually used.

You are handicapped if you cannot supply your customers with the products they desire; your wholesaler is likewise handicapped if he is unable to satisfy your requirements. Neither can function efficiently without the support of the other. The advantage of one reflects in a benefit to the other.

Applying the phrase, "a chain is no stronger than its weakest link," you can realize that you can progress in proportion to the cooperation you and your wholesaler give each other.

Your success is interwoven in the pattern of the wholesaler. The help you gain from the wholesaler is reflected in the services you render your customers in satisfying their many needs.

Give your customers the best service you can provide and the best products you can find and you can be sure of a very successful career. Let us remind you that a tube that will give your customers lasting satisfaction is Wolverine copper tube. Buy it by name — Wolverine.

WOLVERINE TUBE DIVISION
of Calumet & Hecla, Inc., *Manufacturers of tubing*, 1451 Central Avenue, Detroit 9, Mich. Plants in Detroit, Mich. and Decatur, Ala.



How the best product in its field has been made still better

Not overnight, of course—but by a series of improvements gained through research and development resulting in *modernized* cast iron pipe. Tougher, stronger, tuberculation-proof pipe with sustained carrying capacity. Centrifugally cast and, when needed, centrifugally cement-lined.

All of our member companies have centrifugal casting facilities for producing tougher, stronger *modernized* cast iron pipe. All can supply this pipe with cement lining centrifugally applied, resulting in sustained carrying capacity, reduced friction loss and lower pumping costs.

If you want the most efficient and economical pipe ever made for water distribution, your new mains will be laid with *modernized* cast iron pipe with either bell-and-spigot or mechanical joints.

Cast Iron Pipe Research Association, Thos. F. Wolfe,
Managing Director, 122 So. Michigan Ave., Chicago 3.



CAST  IRON

The Q-Check stencilled on pipe is
the Registered Service Mark of the
Cast Iron Pipe Research Association.

Modernized **cast iron**



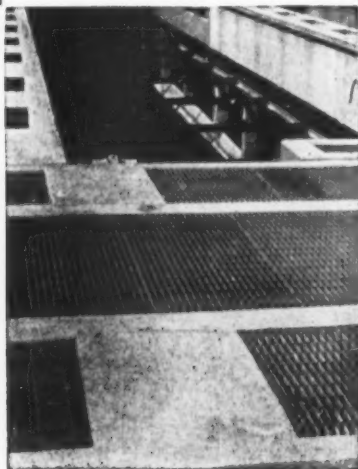
This cast iron water main, uncovered for inspection, is in its 106th year of service in Boston, Mass.—one of more than 40 cities with century-old water or gas mains in service.

pipe

for Modern Waterworks Operation

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DRY!
SAFE!
CLEAN!
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IRVING
"DRYWAY"
GRATING
WALKWAYS and
STAIR TREADS**



IRVING GRATING

Provides the perfect Dry, Clean, Safe flooring for Sewerage disposal Plants. Gratings of Aluminum, Steel and other alloys offer a minimum of Maintenance Cost.

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**IRVING SUBWAY
GRATING CO., INC.**
ESTABLISHED 1902

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**People,
Ideas
and Events**

BY "DOC" SYMONS



H.T.M.A. — And don't expect any comment on the AWWA Meeting. This June Column is being written before May 1, on which date I take off (with my girl, Va.) for Purdue University, Danville, Ill., Grand Rapids, Mich., and Cornell University, with overnight stops along the way, both coming and going.—In the July issue I'll begin the "saga" of that journey.

★ ★ ★

On April 6-8, the Canadian AWWA-ers crossed the border for the first time to hold their annual meeting at the Hotel Statler in Buffalo—and liked it so well that they decided to return some time. Registration was 716, (including a sprinkling of Americans); it was the largest Canadian meeting of any kind ever held in the States.

I had the good fortune to be invited to the Past Presidents' luncheon along with Wendell La Due of Akron, "Casey" (Simplex Valve) Jones, "Dick" (Factory Mutual Ins.) Ellis of Boston, and "Chick" Roberts of Roberts Filter Co. "Chick" regaled us with stories of how M. Des Lauriers of Lachine, Que., (who was at our table) took him, "Chick", to a La Tire (pronounced La Teer), which, we learned, is a big feast when the maple sugar is boiled down to proper strength. Everything you have to eat and drink is cooked in, or with, or flavored with maple sugar or maple syrup, and the dessert is maple syrup poured over snow; real snow.—Most interested listener was Wendell La Due, that Vermont Maple Sugar producer of Akron, Ohio.

Speaking of Wendell La Due, it was at this same meeting that he was listening in on a discussion of adding fluorides to water and he asked the question: "When are we going to start adding bromides to water—to cure water works men's headaches?"

Luminous Quotes — "Wise men learn by other men's mistakes; fools learn by their own."—Cato—100 B. C.

★ ★ ★

As I Heard It — At the N. Y. Section Meeting in Elmira, N. Y.—It does not pay to locate and repair water main leaks if the water loss is less than 3000 gal. per mile per day.—"Charlie" Knoener of Pitometer Co., Albany, N. Y.

—The Mayor of Elmira has welcomed the N. Y. Section three times in 12 years and he thinks John Copley (Water Supt.) is tops.—"Jim" Harding, Comm. of Public Works of Westchester County, joined the AWWA when he was 14 years old; that's how he received a Life Membership at the age of 44 (???).

—"Charlie" Capen, AWWA President, of Wanaque, N. J., said the Russians now claim to have invented water, but give credit to the contributions of such New York Staters as Earl Devendorfsky, Reeves Newsomevitch, "Wally" Millerov, Al Frankovitch, "Jim" Hardingsky, Si Carmenov, Doc Symonoff and others too numerouski to mentionovitch.

—Harvey Howe, V. P. of Lock Joint Pipe Co., just couldn't lose at bridge, much to the chagrin of "Bob" Austin of the State Pub. Serv. Comm. in Albany.

—The Japanese were making cast iron pipe when the Indians owned this country, according to Al Frank, V. P. of National Water Main Cleaning Co., New York, who attended the 22nd annual meeting of the Japanese Water Works Assn.

★ ★ ★

Names Make News — I see where "Charlie" Bourgin has been appointed Engr. and Gen. Mgr. and Secy. of the Bd. of Water Commis—
(Continued on page 145)

YOU'RE 5 YEARS AHEAD when you buy a Jaeger compressor

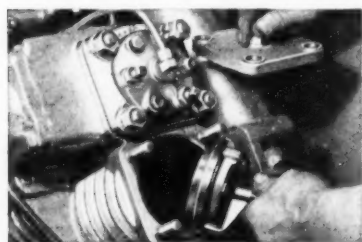
Some compressors are still being built to the old 1932 ratings which are too small for modern air tools.

Other models have recently appeared with the higher ratings needed today.

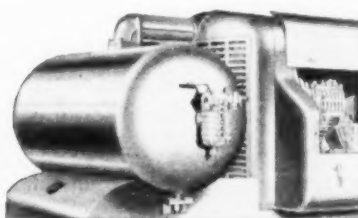
These higher ratings, which others now offer in "new models," are the ones Jaeger has been building for 5 to 7 years, and backs with proved performance of more than 30,000 "new standard" compressors in the field.

NEW:	75 cfm	125 cfm	185 cfm	250 cfm	365 cfm	600 cfm
OLD:	60	105	160	210	315	500

These 15% to 25% higher ratings insure 90 to 100 lbs. pressure at today's big tools, instead of 70 lbs., increasing their work output by 30% to 40%. No "old standard" machine can successfully compress, cool and deliver these larger air volumes. No new compressor has been built to deliver these volumes with the smooth, cool, long-life performance of the Jaeger Air-Plus.



75% to 100% larger valves for free flow without back-pressure.



Larger intercoolers, and air receivers. Relief valve for automatic drainage standard on all models.



Run these tools at 90-100 lbs. pressure

Model 75: 1 heavy breaker

Model 125: 2 heavy breakers or a 55 lb. sinker

Model 185: 3 heavy breakers, 1 heavy rock drill, 2

medium rock drills, or one light wagon drill

Model 250: 3 1/2" wagon drill or 2 heavy rock drills or a 10 hp Ka-Mo earth drill

Model 365: 4" wagon drill plus a plug-hole drill, or runs 15 hp Ka-Mo earth drill

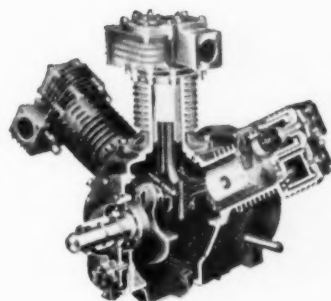
Model 600: Two 4" wagon drills and hand held drill, or runs 9B-3 pile hammer.

THE JAEGER MACHINE COMPANY

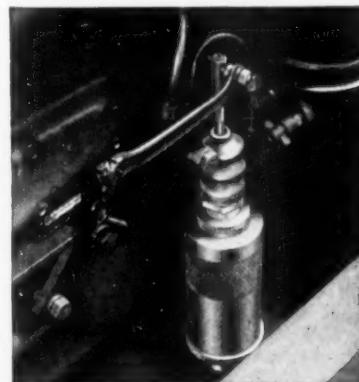
400 Dublin Ave., Columbus 16, Ohio

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Balanced W-type 2-stage compressor standard in all sizes, 75-600 ft. Cooler and smoother running than any V-type.



Jaeger "Fuel Miser" standard on all models where automatic control of engine speeds means worthwhile fuel savings.

Lowest cost compressed air you can buy today

Prices of Jaeger "new standard" compressors are in every case below those being asked for old standard compressors of 15% to 25% less air capacity. On the basis of cost per cubic foot of air delivered, the difference is even greater, amounting to many dollars saving on every cubic foot of air capacity. On the basis of work output, the difference is greatest—amounting to 30% to 40% more production through more efficient operation of your air tools.

Why pay more and get far less when you can buy a proven Jaeger Air Plus Compressor.

For full facts about tools and their air requirements see your Jaeger distributor or ask for Catalog JC-1.

CUT maintenance paint COSTS UP TO 50%

with Dixon **Flake** Silica-Graphite Paints!

This FREE Bulletin shows how! Write for it today!

Just out! This new Dixon bulletin actually can save you up to half your maintenance paint costs. It explains, in non-technical language, how the unique overlapping pigment flakes of Dixon Silica-Graphite Paints form a heavier, stronger paint film that resists cracking and chipping and protects longer. Industrial users of Dixon Flake Silica-Graphite Paints report 9 to 10 years between paintings, against an average of 5 years or less for other paints. Get the whole money-saving story from this new Dixon bulletin. It's **FREE!** Mail the coupon today!



Paint Products Division

JOSEPH DIXON CRUCIBLE COMPANY

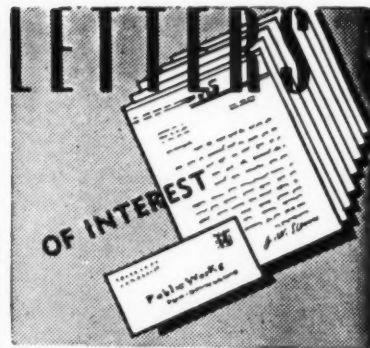
170 Wayne Street, Jersey City 3, N. J.

Yes! I'd like to cut maintenance paint costs up to 50%. Rush bulletin #V-60.

Name..... Title.....
Company.....
Street and Number.....
City..... Zone..... State.....



Now's the time to mail this month's Readers' Service card.



REFUSE COLLECTION

Our newly formed Public Works Commission is making a study of the system of garbage collection used in other municipalities. Our present rubbish and garbage collection contracts expire shortly and will be renewed for a period not to exceed six months. We would appreciate any help you can give us in figuring the relative costs of municipal and private collection.

Normand R. Vadenais,
Commissioner of Public Works
Woonsocket, R. I.

THE NAME'S THE SAME

For the sake of your records, and our own as well, I wish to advise you that there are two of us Arthur Wards in Shelton.

Arthur G. Ward (myself) is City Engineer and my father Arthur L. Ward is County Engineer and formerly was City Engineer as well.

To keep us from fighting over one copy of your magazine, the reading of which we both enjoy very much, I would sincerely appreciate it if you would honor us both with separate copies and thereby promote peace and understanding between our respective offices.

Arthur G. Ward
City Engineer
Shelton, Wash.

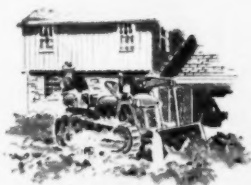
Editor's Note: Glad to do it; and our congratulations to an engineering family.

RESEARCH ASSISTANTS

The State College of Washington has available half-time research assistantships in sanitary engineering starting in September, 1953. Students will be expected to pursue work for the degree of Master of Science in Sanitary Engineering. The rate of pay for the first year will



Loading out scrap material



Bulldozing



Industrial material handling



Backfilling foundations

Take the Word of ...Thousands

Don't just take our word for the real, day-to-day usefulness of the Oliver "OC-3". Take the proof offered by the *thousands* of users . . . the *thousands* of uses . . . of this powerful little tractor. Just ask any owner what he thinks of his "OC-3". In the more than 12 years that the "OC-3" and its predecessor, the "HG", have been in production, they have built a reputation for user acceptance that's unequalled in their class. Proof of this is the fact that it's mighty hard to get a used "OC-3". Users just don't often sell their "OC-3" tractors.

With an "OC-3" and its broad line of matched equipment . . . bulldozer, trailbuilder, front end loader, lifting fork, sidewalk snow plow, hydraulic drawbar, winch, logging kits, and many others . . . you can perform all sorts of useful tasks *every day*.

The "OC-3" has plenty of power to handle all those jobs with ease . . . a full 22 drawbar h.p. It's ruggedly built to keep maintenance and operating costs down.

Why not have your Oliver Industrial Distributor give you all the facts on the "OC-3", the lowest priced industrial crawler tractor built. Call him or write direct to The Oliver Corporation, 400 W. Madison St., Chicago 6, Illinois.



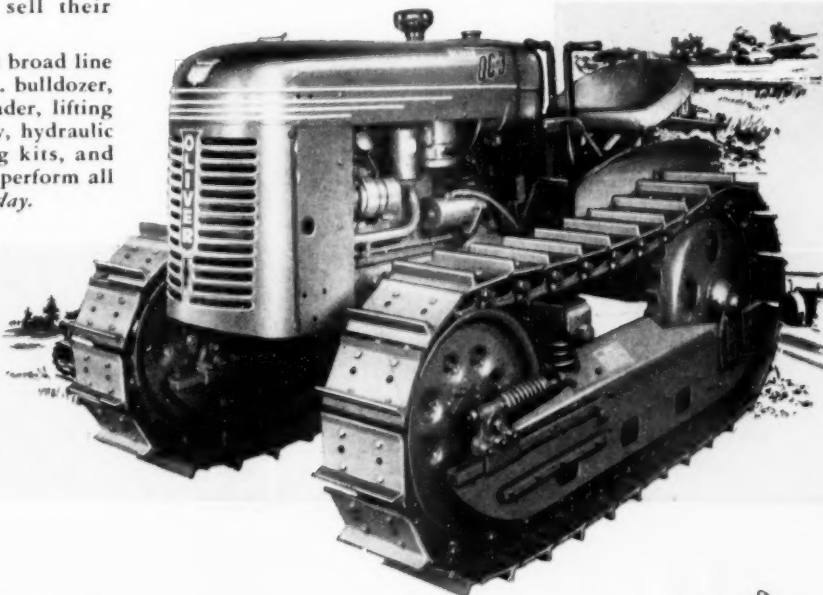
Sidewalk snow plowing



Loading out topsoil



Winch operations

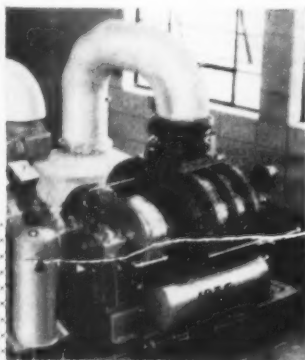


THE OLIVER CORPORATION

a complete line of industrial wheel and crawler tractors

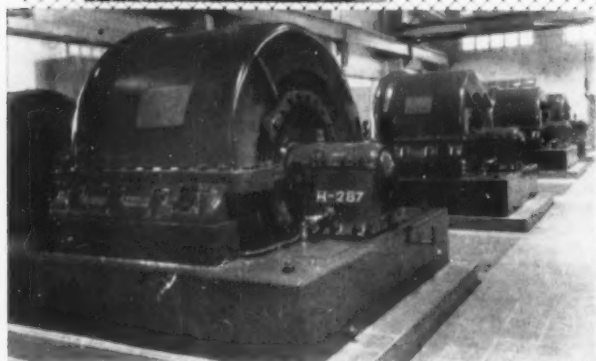


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ROTARY



One important reason for the wide popularity of Roots-Connersville Blowers for sewage treatment work is their versatility. For instance:

TYPES . . . either Rotary Positive or Centrifugal—the only blowers that give you this dual choice.

CAPACITIES . . . from 10 cfm to 100,000 cfm or higher.

DRIVES . . . electric motor in any desired arrangement; gas engine, burning gas, sewage gas or gasoline.

Thus, your selection of blowers is practically unlimited when you consult the R-C specialists. Whether for industrial waste, or for a village or a metropolitan community, you can standardize on R-C equipment. If growth necessitates larger capacity, even after many years, you can add more R-C Blowers as needed, with the same assurance of continued satisfaction and reliability.

Almost a century of experience in building air- and gas-handling equipment, exclusively, is at your call on your blower applications.

ROOTS-CONNERSVILLE

*Exclusive
Specialists
in Handling
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be \$1400; for the second year \$1490. Full-time work is expected to be available during the summer.

Prof. Emmet B. Moore,
Chairman, Dep't. of Civil Engrg.,
State College of Washington,
Pullman, Wash.

• • •

Jobs Available & Wanted

Needed; Salesmen for Water Conditioning Equipment

Three or four salesmen are needed for full-time sales work on water conditioning equipment. Three openings include (1) the central Mississippi Valley area; (2) around New York City; and (3) tidewater Virginia and neighboring sections. Base pay, travel expenses, a car and commission, all on a generous basis. Write to Box LGF, in care of Public Works.

Village Engineer Needed

The Village of Shorewood, Wisc., population about 16,000, needs a city engineer. Desired age bracket 25 to 40; salary range \$4920 to \$5880. For full information, write to Village Manager, 3930 North Murray Ave., Shorewood 11, Wisc.

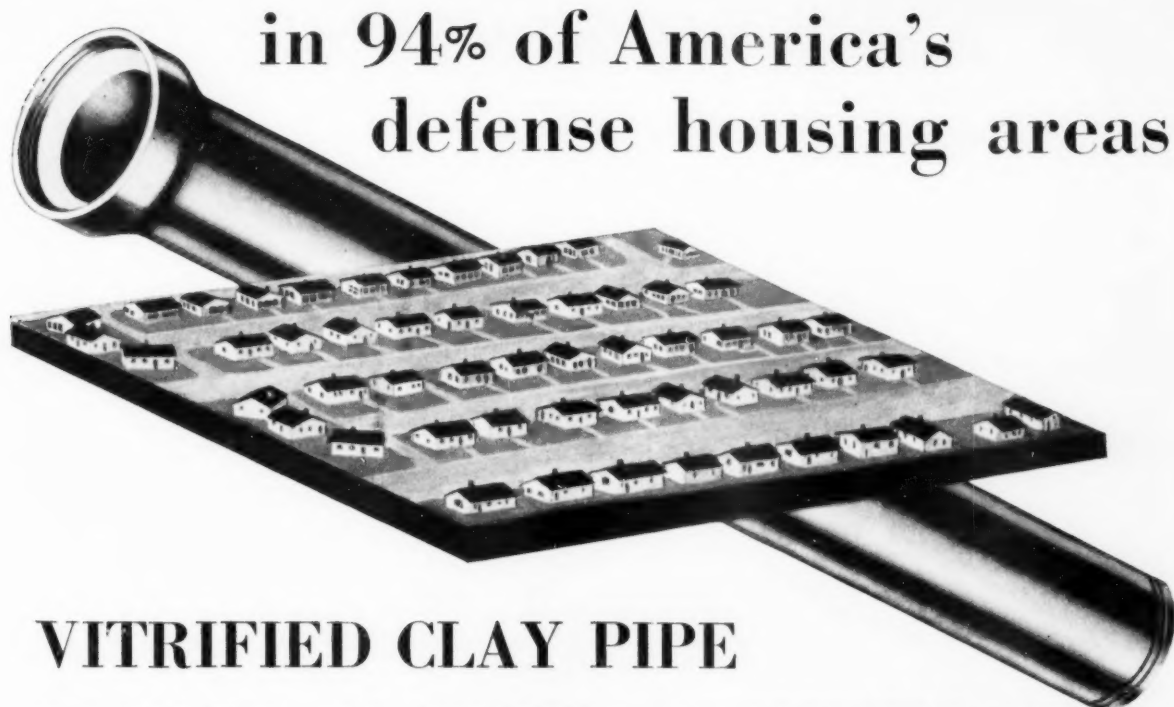
Experienced Writer-Editor Available

A graduate in journalism, a veteran, about thirty, with seven years of experience in all phases of newspaper and radio work, desires an opportunity in sales promotion, editing, or writing. He wishes to remain in the New York metropolitan area, that is, within perhaps 50 miles of New York. Has written feature and magazine articles. Address JK, care of the Editor of Public Works.

Assistant City Engineer

The City of Middletown, Ohio requests applications for the position of Assistant City Engineer. The work involves the responsibility for designing public works structures and for supervising the drafting and surveying necessary for construction. Work is reviewed by a superior. Chances for early promotion excellent. Applicant should be graduate civil engineer or have equivalent experience. Registration as a professional engineer in the State of Ohio required. Monthly salary range is \$376.25 to \$451.50. For further data apply to C. A. Boeke, Service Director, City of Middletown, Middletown, Ohio.

(More on page 132)



VITRIFIED CLAY PIPE IS USED IN SEWER CONSTRUCTION

Fast growing defense areas rely on Vitrified Clay Pipe for permanent, trouble-free sewer lines. Clay Pipe is the one pipe that has **proved** its resistance to corrosion by centuries of actual service in the ground.

Plumbing codes approve Clay Pipe because it never wears out, squashes out, corrodes, or turns spongy in contact with detergents.

Clay Pipe is **guaranteed** for the first 50 years of its service life. There's no safe substitute for Clay Pipe, so why take chances? Always specify Vitrified Clay Pipe . . . and be sure the job is right.

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To the original equipment producer, the Shunk blade, as an integral part of his product, means the assurance of almost a century of development. Shunk's modern production facilities, quality product and reputation guarantee favorable competitive relationships.

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LEADERS IN PUBLIC WORKS



Robert L. Anderson is Superintendent of Public Works and Village Engineer of Winnetka, Ill. He is responsible for all public works functions; for city planning; for regulation of building construction; and for zoning; and is Assistant City Manager. His work at Winnetka has been notable, especially in the development of procedures in operating and constructing sanitary fills, much of which has been described in various papers and in articles in *Public Works*. But the scope of his activities has been broad, and covers all phases of public works.

He is a graduate of Northwestern University, receiving the degree of BS in 1927 and the graduate degree of CE in 1941. He has, incidentally, been with the Village of Winnetka since 1929. He is a member of the Western Society of Engineers; of the American Public Works Association; and of various other technical and professional groups. Of the three Anderson daughters, one is married and the other two are now in college.

In sports, Mr. Anderson lists golf, fishing, hunting and bowling. But a chief interest is agriculture, for he owns and operates five farms in northern Illinois, which should keep him a mite busy aside from his regular work. He enjoys music; is a rotarian; and is active in church work. We are happy to picture him in this issue, for he is typical of the many fine engineers who are devoting their talents and skills to public service.



HOLMES-OWEN TRUCK LOADER provides worthwhile savings on such jobs as repaving, repairs and maintenance of streets, roads, parks, etc.



VERSATILE ONE MAN USE reduces cost of street cleaning, removal of debris, broken pavement, snow, hard deposits of washed-in dirt, trash, etc.



LOADER enables Truck Driver to speed-up loading and hauling of materials, thereby offering substantial savings in cost per ton handled.

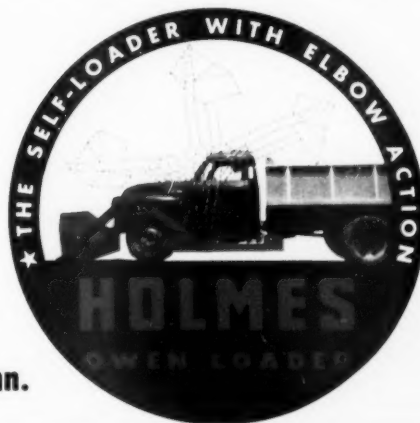
The HOLMES-OWEN LOADER is hydraulically operated, lifts $\frac{1}{2}$ yard per bucket, loads the average truck in 4 minutes and can be installed on most any $1\frac{1}{2}$ to 2 Ton Truck. For full information see your equipment dealer or write factory direct.

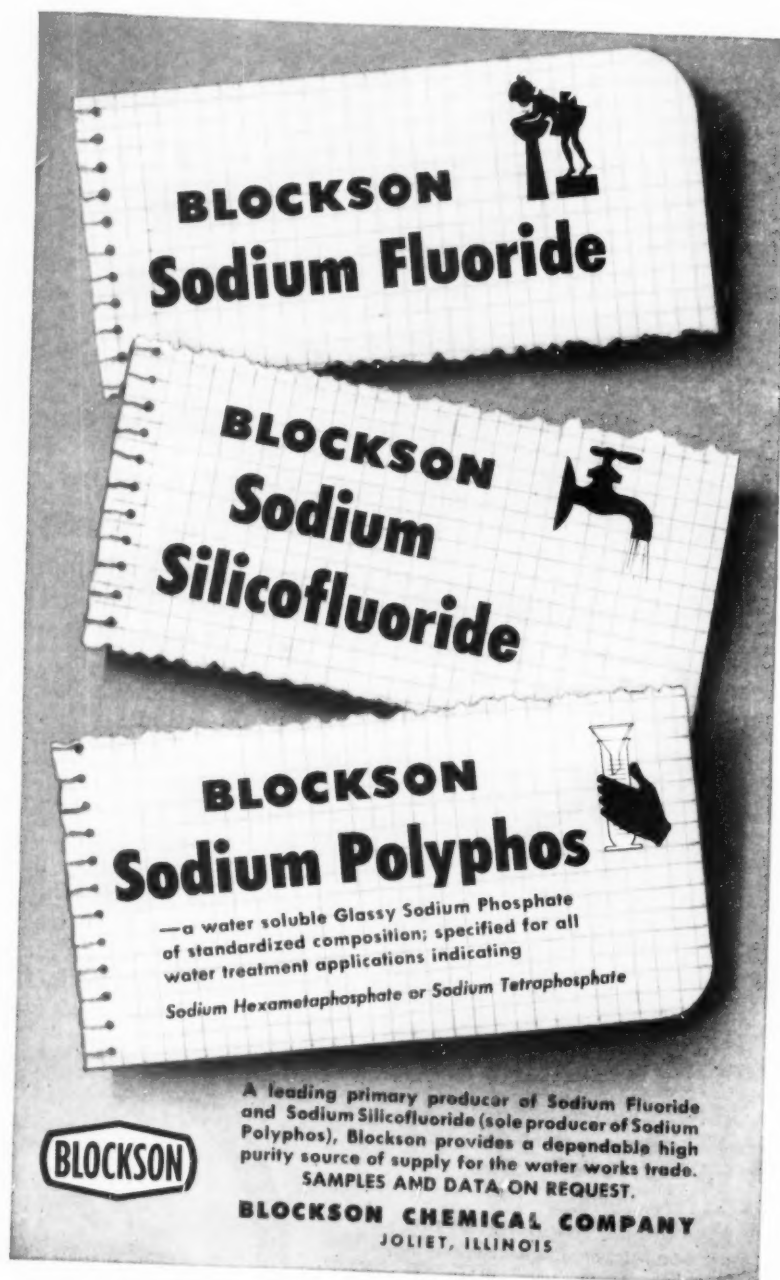
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ERNEST HOLMES CO., Chattanooga, Tenn.

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WORK-SAVER
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and Numerous
other operations

◀ CUTS cost of many Jobs as much as 50%

Cities throughout the nation are today reducing the cost of street maintenance, handling of stockpile materials and many other operations with trucks that are equipped with a HOLMES-OWEN LOADER. The use of a truck loader speeds up hauling and loading, thereby assuring faster, more efficient work. It saves time, labor and equipment by permitting the truck driver to do light digging, grading, cleaning up and loading, without the need of additional manpower or the use of more costly equipment. A truck with such versatile one-man operation can easily do the work of several men, and as such, becomes a valuable asset in reducing today's high cost of operations.





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Sodium Fluoride

BLOCKSON
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—a water soluble Glassy Sodium Phosphate of standardized composition; specified for all water treatment applications indicating Sodium Hexametaphosphate or Sodium Tetraphosphate

BLOCKSON

A leading primary producer of Sodium Fluoride and Sodium Silicofluoride (sole producer of Sodium Polyphos), Blockson provides a dependable high purity source of supply for the water works trade.
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There's a Remington Rand insulated Safe-Cabinet product for certified fire protection of every type of record. Safe-Cabinet equipment provides up to 4 hours' security from fires up to 2000°F. in intensity.

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Model 47 Chem-O-Feeder
... for hypochlorite, alum, soda
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you've got to
Swing that Rear-End
for TOP performance

Moving a heavy windrow up the slope from ditch to shoulder without sliding sideways is a tough job for an ordinary grader . . . no problem at all for an Austin-Western Power Grader with its exclusive All-Wheel Drive and All-Wheel Steer.

Rear Steer places a wheel in the ditch where it runs true and smooth, and braces itself against the bank. All wheels miss the windrow, and the blade moves it farther than would otherwise be possible.

Whatever the work . . . whatever the going . . . an Austin-Western Power Grader is your best bet. All-Wheel Drive provides maximum traction with 30 per cent more Power-At-The-Blade. All-Wheel Steer teams up with All-Wheel Drive on job after job . . . those pictured on this page and many others . . . where it pays off in smoother work, done more easily and quickly, to be able to SWING THAT REAR-END!

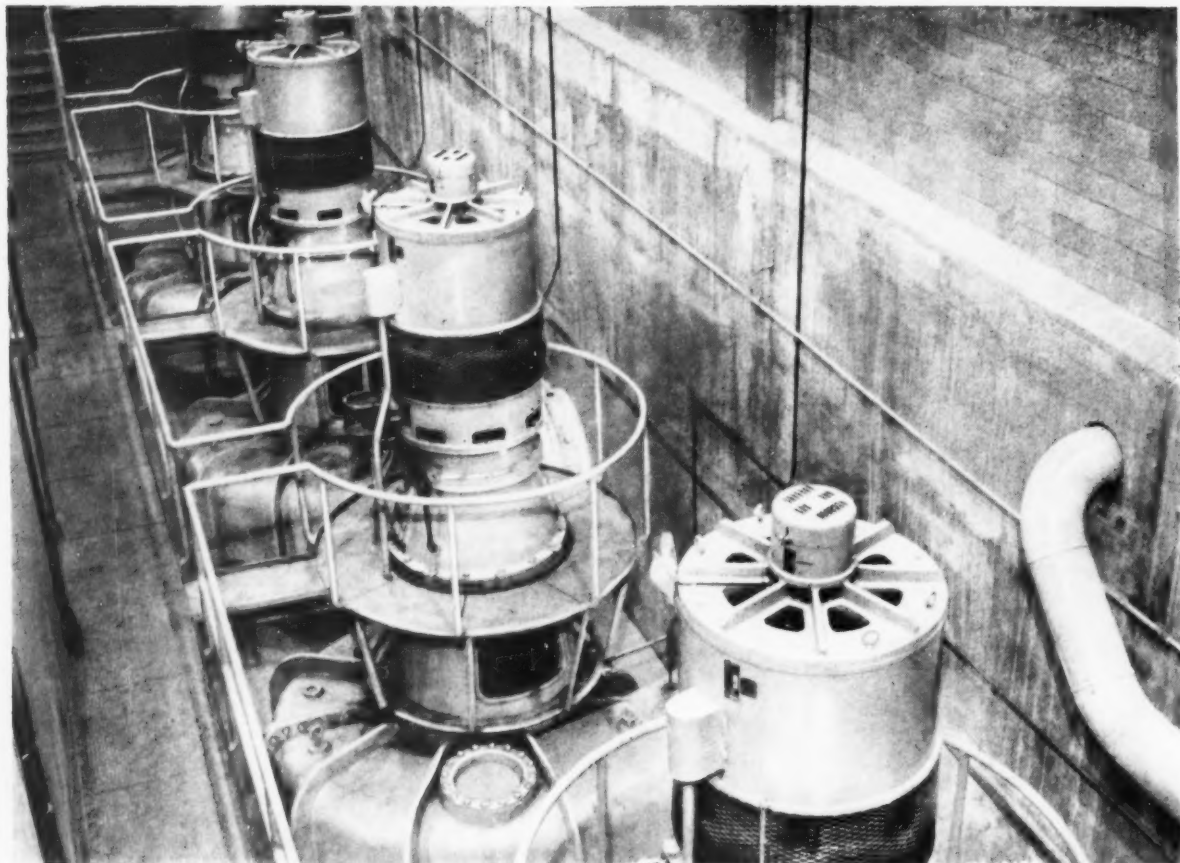
... **handling many other jobs**

Austin-Western
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Road Rollers • Motor Sweepers

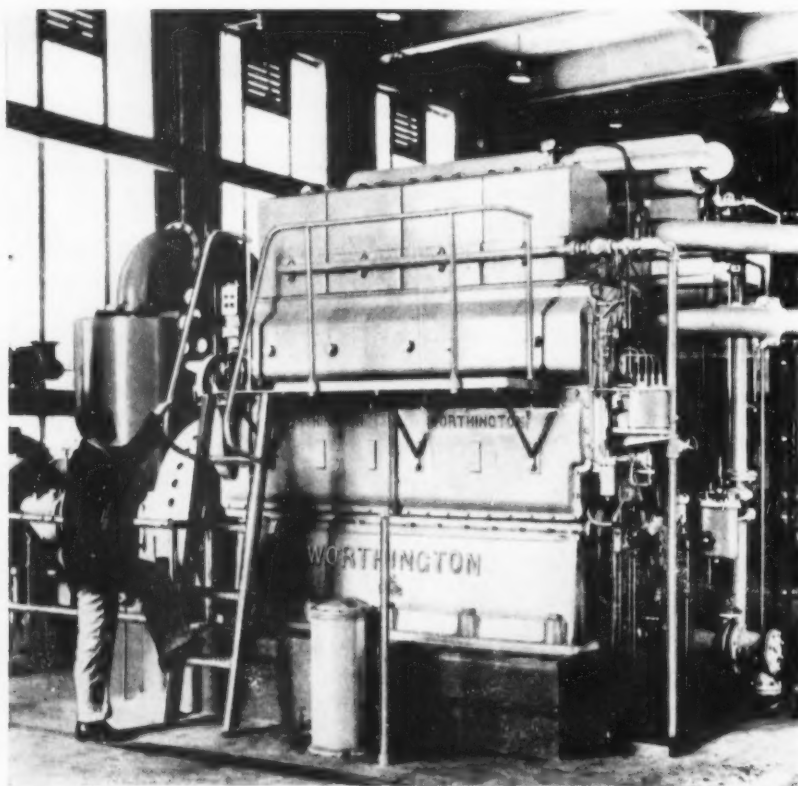


Construction Equipment Division

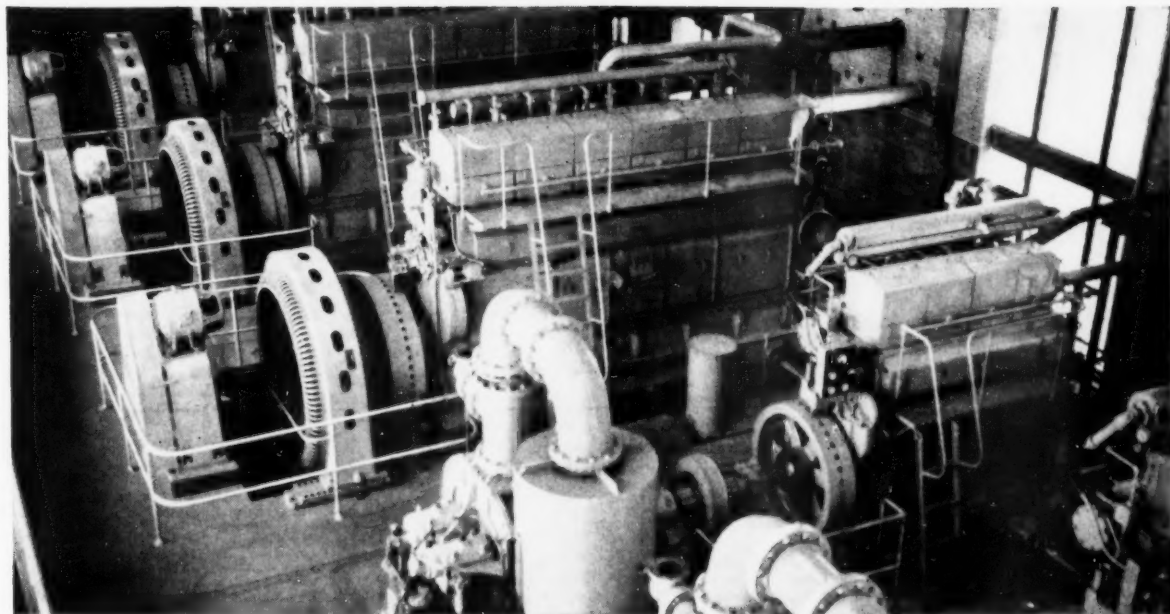
Manufactured by
AUSTIN-WESTERN COMPANY
 Subsidiary of Baldwin-Lima-Hamilton Corporation
 AURORA, ILLINOIS, U.S.A.



↑ **FOUR OF THESE WORTHINGTON MIXFLO PUMPS**, each with a capacity of 83 million gallons per day, move sewage through various stages of its treatment at Boston's Nut Island Plant. The pumps are designed to operate at variable speeds through the use of the magnetic drive which in connection with Worthington float control will maintain a pump-well level of not more than 3 inches above or below normal—even though pumping rates vary between 35 and 300 mgd



← **PRESENTLY USING SEWAGE GAS AS FUEL**, these Worthington dual fuel engines are designed to operate on either gas or oil. They will maintain load in the event of a sudden emergency loss of gas supply by automatically switching to oil. Two of these 215-hp units drive the sewage aeration blowers at Boston's new sewage treatment plant at Nut Island



DUAL FUEL ENGINES AUTOMATICALLY MAINTAIN LOAD in the event of a sudden emergency loss of gas supply. These two 820-hp dual fuel engines and one 830-hp spark ignition gas engine drive three Electric Machinery generators. Two 215-hp dual fuel engines in the foreground drive positive displacement blowers.

Worthington equipment at Nut Island Plant helps Boston reclaim Quincy Bay beaches

Mixflo pumps have maximum capacity of more than 300 mgd of sewage

The new \$10,000,000 Nut Island Plant at Quincy, Mass., is now treating 95 mgd of raw sewage which was previously pumped directly into Quincy Bay.

Four large Worthington Mixflo pumps, with Electric Machinery motor and magnetic drive, each with a capacity of 83 mgd, give this modern sewage treatment plant a reserve potential to meet any future demands.

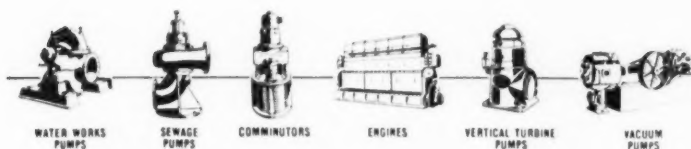
Three large Worthington dual fuel engines drive the Electric Machinery generators which power the entire plant. Two smaller Worthington

dual fuel engines drive the blowers for aeration of the sewage.

In addition to its larger pumps and engines shown here, Worthington also supplies comminutors, smaller sewage pumps, sludge removal pumps, and vertical turbine pumps for the water and sewage field.

Write us for a list of Worthington installations in your area, and complete information on how Worthington equipment can solve your sewerage problem. Worthington Corporation, Public Works Division, Section W.3.1, Harrison, N. J.

W.3.1



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WORTHINGTON



Public Works Equipment

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How to Get Better Concrete Construction

198. A comprehensive report on the use of "Pozzolith" as a means of increasing the strength and durability and reducing the permeability of concrete structures, while reducing costs at the same time, is presented in 32-page Bulletin LH 9-52 of Master Builders Co., Cleveland 3, Ohio. Every engineer and contractor should study this helpful data. Check coupon for your copy.

Data on Brine Production And Softening Applications

94. A comprehensive manual covering all aspects of brine production from rock salt and its industrial applications, including regeneration of zeolite water softeners, is available from the Cayuga Rock Salt Co., Myers, N. Y. Check the coupon for your copy of this interesting publication.

How to Construct A Sanitary Fill

105. With good procedure and proper use of equipment you can have a true sanitary fill. Initial planning, construction procedures for various topographical conditions, the right way to use equipment and handy tips on controlling the fill are all included in a booklet issued by the Drott Mfg. Co., Milwaukee 8, Wis. Just check the coupon.

Highway Maintenance Handbook Answers Troublesome Problems

134. An informative new handbook available from Solvay Process Div., Allied Chemical & Dye Corp., 61 Broadway, New York 6, N. Y., gives practical help on numerous maintenance problems, including patching, shoulder maintenance and dusting. Check the coupon for free copy.

Better Mowing and Brush Removal

30. Fast, versatile Wood rotary mowers are available in seven models to suit all types of municipal maintenance. Upkeep costs for roadside mowing, brush cutting, leaf mulching, park maintenance can all be reduced with efficient equipment. Get full details by checking the coupon. Wood Bros. Mfg. Co., Box 148B, Oregon, Ill.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the coupon, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

Complete Sanitation and Process Equipment Bulletin

40. A complete illustrated bulletin gives detailed information on all "Rex" sanitation and process equipment. 36 pages of engineering data, process descriptions, conversion factors. Get Bulletin 51-83 by checking the coupon. Chain Belt Co., Box 2022, Milwaukee 1, Wis.

See page 38 for selected references to literature describing equipment and materials for patching pavements.

Helpful Data on Pipe Repairs

300. CirtelSeal clamps for repair of breaks, leaks or corroded areas in all types of service pipe are described in bulletin issued by R. H. Baker & Co., Inc., 2070 E. Slauson Ave., Huntington Park, Calif. Check the coupon for a copy.

Get the Facts on The Contact Aeration Process

303. Full engineering details on the submerged contact aeration process of sewage treatment, including diagrams of plant units, area requirements, operating costs and other details are available in a bulletin of the Hays Process Co., Box 768, Waco, Texas. Check the coupon to get the facts.

A Short Course In Pipe Jointing

103. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled, permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the coupon for free copy.

Data Offered on Water, Sewage and Waste Treatment Equipment

LINK-BELT
water, sewage and waste
treatment equipment



263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Columbia, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Triton screens, flash mixers, scum breakers and other units are described. Check the coupon for your copy.

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon.

See What You Can Do With A Force-Feed Loader

93. In a new booklet available from Athey Products Corp., Chicago 38, Ill., you will find full descriptions and on-the-job photos showing how the Athey Model 3 Force-Feed Loader is used by county and municipal forces for loading berm trimmings, broken pavement, snow and other materials. Many special features that increase the effectiveness of this machine are discussed in the folder. Get your copy by checking the coupon.



How the Mobil-Sweeper Can Improve Street Sweeping

305. Sweeping costs can be cut with the Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt

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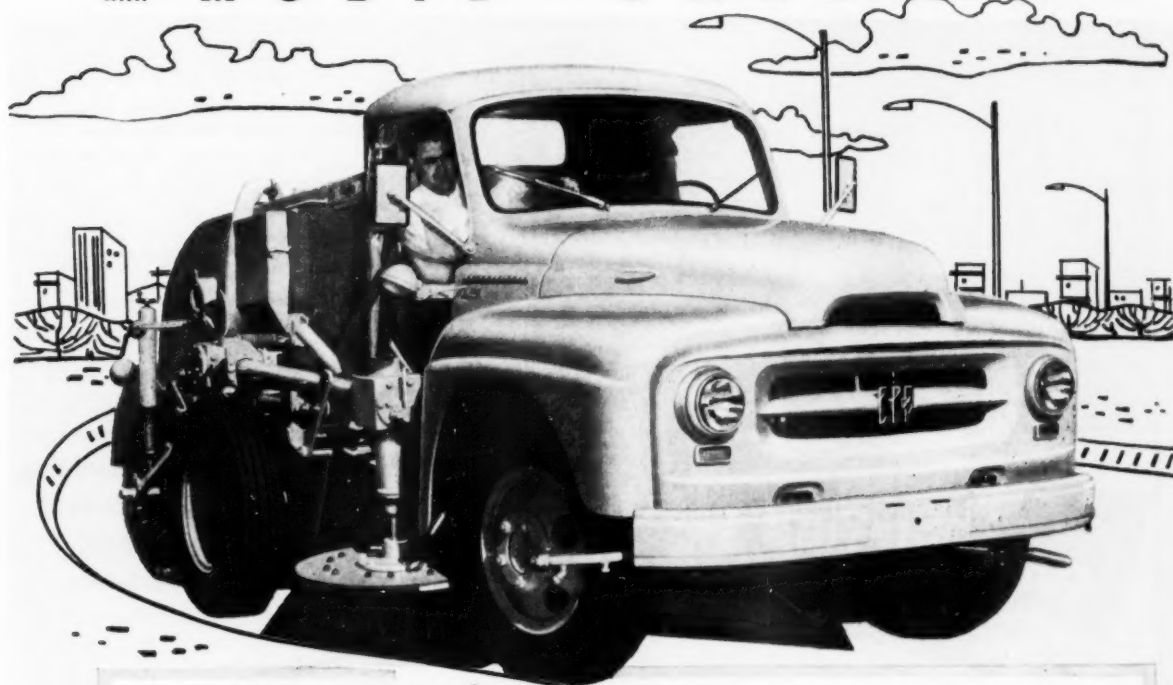
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hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Helpful Data on Bermico Pipe Fittings

262. Data are now available on fittings for use with Bermico sewer pipe and perforated pipe—T's, Y's and bends to make complete roofproof, water tight, corrosion-resistant Bermico pipe systems. Get full information by checking the coupon. Brown Co., 150 Causeway St., Boston, Mass.

Truck Crane Does Many City-County Jobs

37. A new 6-page bulletin describing their 6-ton, 34-yard truck crane has been issued by the Schield Bantam Co., Waverly, Iowa. Complete data is provided on weights, applications and production output of 8 different attachments, including clamshell and dragline, concrete bucket and pile driver. Easy-to-read charts show lifting capacities for 25' and 45' booms. Detailed specifications and information on truck mountings are included. Check coupon for Bulletin TCR-201.



Small Power Sweeper For Easier Maintenance Work

240. Modern maintenance of parking lots, congested city streets, park areas, etc. can be simplified with the Modern Mfg. Co. power sweeper, described in a bulletin available from Modern Mfg. Co., 160 N. Fair Oaks Ave., Pasadena 1, Calif. Check the coupon for your copy.

Vacuum Cleaning Answers Leaf Problem

227. The Elliott vacuum leaf loader quickly sucks wet or dry leaves from the

street and deposits them into a collecting truck for easy disposal. All-season use for removal of paper and other debris. Details on this time and labor saving unit in bulletins from M. A. Elliott, 5 State St., Troy, N.Y. Check the coupon.

Quel—For Control Of Garbage Odors

27. A new product, Quel, is offered to stop odors from garbage and waste. A small quantity of this liquid is said to sanitize garbage containers, kill maggots, repel flies and other pests. Get full details from W. B. Farrell, Inc., 1960 Opdyke Rd., Pontiac, Mich. Check the coupon.

REFUSE COLLECTION AND DISPOSAL

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy coupon.

Save Garbage Collection In Defense Housing

181. Defense housing projects won't drain manpower for garbage collection when Westinghouse Waste-Away Food Waste Disposers are installed in each kitchen. Helpful information for community planners is offered by Westinghouse Electric Corp., Electric Appliance Div., Mansfield, Ohio. Just check the coupon.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

Valuable Booklet on Porous Diffuser Plates and Tubes

21. A helpful 20-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in activated sludge plants. Full data for the designing engineer is provided by careful detailing of physical characteristics of plates and tubes. Maintenance of porous media also is discussed at some length. For your copy of Form 1246, write the Norton Co., Dept. P.W., Worcester 6, Mass., or use the coupon.

How Cities Clean Sewer Lines From Street in One Operation

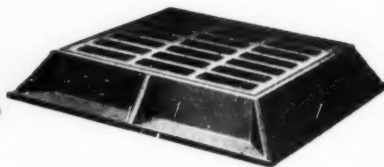
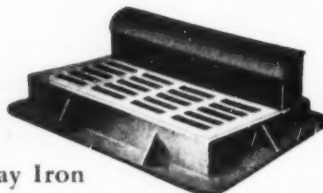
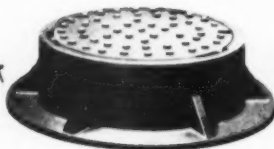
25. In a helpful 28-page handbook of sewer cleaning methods and equipment the makers of OK Champion sewer cleaners give full details of power and hand operated models. Also included are data on expansion buckets that take dirt from sewer to street in one operation, root cutters and other accessories. Get your copy by checking coupon. Champion Corp., 4752 Sheffield Ave., Hammond, Ind.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 40-page booklet issued by Flexible Sewer-Rod Equipment Co., 9059 Venice

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Blvd., Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweKodeK, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook.

Helpful Design Data For Sewage Ejectors

81. The applications and advantages of pneumatic sewage ejectors are outlined in a new bulletin of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems. Get your copy by checking coupon.

Using Sewage Sludge Gas For Power Generation

90. Fairbanks-Morse dual fuel engines can operate on either sludge gas or oil to provide steady power output despite fluctuations in gas supply. Bulletins are available on several sizes to meet your needs. Write, giving exact requirements to Fairbanks, Morse & Co., Dept. PW, 600 So. Michigan Ave., Chicago 5, Ill. or use handy coupon.

Floatless Liquid Level Controls

92. Complete descriptions of electrode type floatless liquid level control systems, including control units, electrodes and fittings, panel assemblies and diagrams of typical installations for all types of municipal service are covered in the 32-page catalog of Charles F. Warrick Co., 1956 W. Eleven Mile Rd., Berkley, Mich. Check coupon for your copy.

Forms for Every Concrete Pipe Shape

95. In addition to this complete line of forms for standard concrete sewer and drainage pipe, special forms for varied shapes of every type are listed in the Quinn Concrete Forms Catalog. Copies available by checking the coupon, or write direct to Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use coupon or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

Data Offered On Mixed Flow Pumps

201. Data on the complete line of Worthington Mixflo pumps of the two-vane, non-clogging sewage type is offered in 16-page bulletin W-317-1116. Salient features are outlined, typical sections, performance curves and general data for five types are included. Helpful charts aid shafting selection. Copies available by using coupon or from Worthington Corp., Harrison, N. J.

Trenching Made Easy With Hydraulic Dragshovel

216. The Bucyrus-Erie "Hydro-Hoe", a completely hydraulic dragshovel has two separate digging actions to dig a level, scallop-free trench and greatly reduce hand trimming. Be sure to investigate this rugged, easily operated machine. For details write Bucyrus-Erie, Hydrocrane Div., So. Milwaukee, Wis., or check the handy coupon.

Efficient Blowers for Activated Sludge Plants

232. Many advantages of Roots-Connersville positive displacement rotary blowers are described in Bulletin 22-23-B-13, which also provides characteristic curves for operation with constant speed, multi-speed and variable speed motors and details of several types of blowers. Get this helpful bulletin by checking the coupon. Roots-Connersville Blower Corp., Connersville, Ind.

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves is contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., 200 Eliot Street, Fairfield, Conn.

Comminutors for Automatic Disposal of Coarse Sewage Solids

152. The problems connected with disposal of coarse sewage solids are eliminated by clean, odorless, automatic Commiunutors. Full engineering data show the proper model for every size plant and furnish details of hydraulics and typical installations. Chicago Pump Co., 622 Diversey Pkwy., Chicago 14, Ill.

Book Tells How to Control Root Stoppages

249. Details on the proven use of copper sulfate to control root and fungous growth in sewers are contained in a brand-new book published by Phelps Dodge Refining Co., 40 Wall St., New York 5, N. Y.

Instrumentation and Control Equipment For Water and Sewage Plants

298. Full engineering data on the instrumentation and control equipment needed in water works, sewage plants, pumping station and related installations are provided in the "Application Engineering Data" binder issued by the Foxboro Co., Foxboro, Mass. Every engineer and designer should have this valuable material on hand. Check the coupon if you can use this data.

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154. Operating on the Diesel cycle, burning either oil or gas, the Worthington Supercharged Dual Fuel Diesels give high economies by running on the cheapest fuel available. Get complete data from Worthington Corp., Dept. PW, Harrison, N. J.



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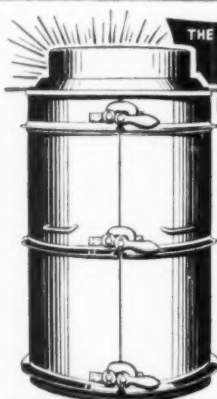
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22. Quick cuts in pavement are easily made with the Tri-Line concrete cutter, which leaves a smooth, clean edge to prevent spalling of patch material. For all details on the Tri-Line cutter and double-banded diamond blades get form 500A from Tri-Line Co., 921 Carroll St., Racine, Wis. Just check the coupon.

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39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy coupon for full data. Ernest Holmes Co., Chattanooga, Tenn.

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41. In 36-page catalog AA a full line of maintenance is covered. Units described and illustrated include several models of pressure distributors, supply tanks, sprayers, brooms, asphalt kettles, portable rollers, and accessory tools. Use coupon for copy of this handy manual. Littleford Bros., 452 E. Pearl St., Cincinnati 2, Ohio.

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55. Be sure to get your copy of "Saving Facts", an illustrated booklet prepared by The Oliver Corp. that shows how equipment dollars can be stretched on municipal work. Text and photos describe the application of tractors and money-saving attachments in street maintenance, snow removal, waste disposal, pipe laying and other projects. Write The Oliver Corp., Industrial Div., 400 W. Madison, Chicago, Ill. or check coupon.

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Helpful Data on Distributors For Bituminous Materials

79. Two models of pressure distributors featuring uniform pressure and temperature, accurate displacement pumping are covered in bulletins available from Standard Steel Works, Dept. PW, North Kansas City, Mo. Check coupon for copies.

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85. When the sides of patches and trenches are sawed before breaking, a saving of 25% in removal costs is claimed. And the smooth, straight edges won't spall or crack after replacement material is poured. Investigate the exclusive features that give maximum economy to Clipper concrete saws. Full information from Clipper Mfg. Co., 2823 S. Warwick, Kansas City 8, Mo., or check the handy coupon.

Faster Compaction On Street Repairs

108. Holes and trenches cut through pavement present difficult areas for compaction of backfill. Learn how to do the job quickly, easily and cheaply by using the self-contained, portable Barco Rammer. Full data on this low cost will be found in Bulletin 621. Write Barco Mfg. Co., 500 No. Hough St., Barrington, Ill., or check the coupon.

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137. Etnyre maintenance units speed the work on all small maintenance and construction jobs. Trailer or skid mounted units have easy to operate controls for spraying through bars up to 12 ft. long, hand spraying, and transferring. Form 351 gives complete data. Write E. D. Etnyre & Co., Oregon, Ill., or check the coupon.

Three-Wheel Roller For General Purpose Duty

142. A 20-page bulletin describing general purpose 3-wheel rollers covers 8, 10, 12 and 14-ton gasoline and diesel models of the Huber line. Illustrations and comprehensive explanation show component parts of the rollers and describe the general duties of the units. For your copy of this attractive bulletin, No. H-150, write the Huber Mfg. Co., Marion, Ohio, or use the coupon.

Drill Concrete Faster and Easier

146. Your rotary electric or air drill, used with RCD drill bits, will drill precision holes even in reinforced concrete. Bits available in 1/4" to 4" sizes and larger. Get illustrated bulletin and price list from Rotary Concrete Drill Co., 650 S. Arroyo Pkwy., Pasadena 1, Calif. Just use the coupon.

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171. Maximum economy in paving maintenance and repair is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Check all these features by getting form 210 from Wylie Mfg. Co., 416 S. W. 23rd, Oklahoma City, Okla. Use the coupon.

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199. Troubles arising from difficult patching conditions, variables in the components of bituminous mixes, stockpiling for long periods, stripping and destructive action of water are minimized by the use of Kotal in the mix. Several bulletins show how Kotal may be used to advantage and present authoritative laboratory reports. Check the coupon for data from the Kotal Co., 360 Springfield Ave., Summit, N. J.

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304. By preparing your patching mixtures, hot or cold, right on the job, you can use them immediately with a minimum of handling. Get full data on the McConaughay Model HTD "Multi-Pug" Asphalt Mixer for fast, easy and economical preparation of patch materials. Write K. E. McConaughay, Lafayette, Ind., or use the coupon.

Speed Concrete Removal And Make Better Patches

202. Felker self-propelled concrete cutters saw to 6 1/2" depths to facilitate concrete removal and produce smooth, straight edges which resist spalling when patched. Full data on cutters and segmented type diamond abrasive wheels are available from Felker Mfg. Co., Torrance, Calif. Check the coupon today.

Drill Concrete With Your Ordinary Electric Drill

295. Substantial cost-per-hole savings are claimed for Tilden Rotary Drills which penetrate 2" to 4" per minute. Available in sizes 1/4" to 4". Cutters can be resharpened. Full data from Tilden Tool Co., 209 Los Molinos, San Clemente, Calif. Just check the coupon.

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205. The H & B Moto-Patcher delivers up to 10 tons of freshly mixed material per hour for speedy, low cost maintenance work on roads and streets. Details on this unit, including flow diagram of mixing operation, specifications and pictures of the unit in use are included in Bulletin MP-51, available from Hetherington & Berner, Inc., Indianapolis 7, Ind. Check the coupon.

Fast-Heating Kettle Ready for Big Jobs

206. The new Jumbo-sized Acroil Heet-Master kettle features fast, fuel-saving internal tube heating system; easy trailing; low loading height. Get details in Bulletins 400 and 677 by checking the coupon. Acroil Products Co., Inc., So. Hackensack, N. J.

How Air Placement of Concrete Will Help on Your Jobs

215. There are hundreds of jobs that can be done easier and cheaper by air placement of concrete; reservoir, tank and pool linings, concrete maintenance of all sorts are just a few of the applications. Get full details on two models of the high speed, easily operated "Bond actor" from Air Placement Equipment Co., 1009 West 24th St., Kansas City 8, Mo. Check the coupon.

Get Full Data On Aggregate Spreaders

231. Accurate control for spreading crushed rock, chips, sand or icy control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on both trailer and tailboard types available by checking the coupon. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

How To Build Stabilized Heavy Traffic Pavements

233. A 16-page booklet published by Seaman Motors, Inc., Milwaukee, Wis., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer. Check coupon for copy.

Profitable Construction with Payloaders

234. A comprehensive, 12-page catalog filled with on-the-job photos showing a wide variety of earth-moving, material-handling, lifting and carrying jobs being performed by the multi-purpose tractor-shovels known as "Payloaders" is now available. Helpful job data, specifications and features of the complete Payloader line are included, with illustrations of useful accessories. Copies of this colorful catalog No. 217 can be obtained from The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Ill., or by checking the coupon.

Doing Patching? Check This Aggregate Dryer

254. The mobile Tarco "Flash-Flame" aggregate and material dryer can be a big help on patching work by producing hot aggregate or rewarmed winter mix wherever you need it. Complete description and specifications in bulletin from Tarrant Mfg. Co., Saratoga Springs, N. Y. Get your copy by checking the handy coupon.

Heating, Thawing and Melting With Hauck Burner Equipment

277. A helpful 16-page bulletin covers the complete line of Hauck heating and melting equipment. Data covers units for every water, sewer and street department purpose, from "one-man" burners to large size portable kettles. For a useful addition to your reference file, get Bulletin 1068 from Hauck Mfg. Co., 117-127 Tenth St., Brooklyn 13, N. Y.

Patching and Maintenance With Bitumuls

283. Proper maintenance of paved surfaces is the subject of an informative 24-page booklet "Bitumuls for Maintenance" published by American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 4, Calif. Profusely illustrated and well-written, this text gives step-by-step descriptions of patching and other surface maintenance operations. Check the coupon now to order your copy.

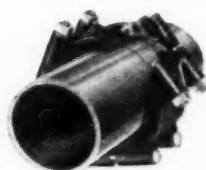
DRESSER JOINTS, FITTINGS, REPAIR CLAMPS, SLEEVES

**A complete line
for all types and
sizes of water pipe**



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Style 38
DRESSER COUPLINGS**

Proved dependable for over sixty years, on thousands of miles of municipal supply and distribution mains. Special rubber gaskets make a permanent joint, flexible enough to permit laying curves with straight pipe. Wrench is only tool needed. Available for plain-end steel, cast iron or other pipe, $\frac{3}{8}$ " ID to 72" OD and larger.



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Handy sleeve repairs breaks, holes and splits in straight run of CIP quickly and securely, without service interruption. Highly adjustable for off-size pipe. Also makes a handy tapping sleeve, when needed. Sizes 4", 6", 8" CIP.



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ADJUSTABLE BELL-JOINT CLAMP**

Highly adjustable Style 60 has wide use in water repair work. Especially good on locations subject to vibration, such as under railroad tracks, heavy traffic spots, and on bridges. Sizes 3" through 60" CIP.



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TO EXISTING LINES
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A quick easy way to make branch connections to existing lines when tapping sleeves, tees, or other methods are not desirable. Standard saddle is equipped with exclusive Dresser rubber gasket. Also available with lead gaskets or without gaskets. Malleable and steel construction for steel and CIP. Sizes $1\frac{1}{2}$ " to 20" OD.



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Style 65
"NO-THREAD" FITTINGS**

No threading or exact pipe alignment is necessary with these simple, speedy fittings. Just stab over plain pipe ends and tighten bolts with a wrench.

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**FOR LEAKS, BREAKS, SPLITS
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CAST SPLIT SLEEVE**

Standard equipment with emergency crews for repairing unexpected breaks requiring immediate attention. Used successfully for years by water departments everywhere.

Each sleeve is tested with 60-lb. air pressure and 500-lb. hydrostatic pressure before shipment. Sizes 2" to 12" CIP.

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products for the municipal field. A complete list includes: Couplings • Insulating Couplings • Reducing Couplings • Long Sleeves • Tees, Ells, Crosses • Pipe Saddles • Expansion Joints • Split Repair Sleeves • Bell-Joint Clamps • Collar, Screwed Fittings, Clamps, Band and Saddle Clamps • Service Fittings.

Catalogs and further information on request

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Dresser Manufacturing Division (One of the Dresser Industries), Bradford, Pa.
Sales Offices: New York, Philadelphia, Chicago, Houston, San Francisco. Warehouses in Houston and South San Francisco. In Canada: 629 Adelaide St., W., Toronto, Ont.

Get full details of this month's new products... mail your Readers' Service card today.

To order these helpful booklets check the coupon on page 32.

WATER WORKS

Head Loss Data On Plastic Pipe

26. Carlon Products Corp., 10225 Meech Ave., Cleveland 5, Ohio, announces that authoritative data has been compiled on head loss due to friction in Carlon plastic pipe and is available in the form of graphs and charts. The graphs show superior flow characteristics, attributed to the fact that plastic pipe is not "wetted" by water. Send for this data today by using the handy coupon.

Water Level Controls for Sewage and Water Plants

31. Dependable float-operated pump and motorized valve controls for single or multiple pump installations are described in bulletins issued by the Water Level Controls Div., Healy-Ruff Co., 719 Hampden Ave., St. Paul 4, Minn. All units feature splash proof construction, mercury tube switches.

What You Should Know About Chemical Proportioning Pumps

38. In an attractive new bulletin you will find latest information on the Heavy-Duty Chem-O-Feeder, plus many installation diagrams, construction and operating details, list of chemicals fed and other helpful information on constant rate and flow proportional chemical feeding. Get your copy from Proportioners, Inc., Providence 1, R. I., by checking the coupon.

Design Data for Hardness, Turbidity, Color or Algae Removal

253. Bulletin No. 9041 published by The Dorr Co. furnishes design data on the Hydro-Treater for high-rate, upflow type treatment of municipal and industrial water supplies. 32 pages include distinguishing features of the unit, types and sizes, capacity ratings and typical operating results. Get your copy of this helpful bulletin by using coupon today. The Dorr Co., Barry Pl., Stamford, Conn.

Technical Data on Fluorides And Other Chemicals

48. Technical data on fluorides and other chemicals will be found in a comprehensive booklet issued by Blockson Chemical Co., Joliet, Ill. This helpful 60-page booklet includes a great deal of general information of value to water works men. Get a copy by checking the coupon.

The Turbidimeter Without Standards

51. The Hellige Turbidimeter is designed for accurate measurement of water turbidity, sulfate determinations, and measurements of suspended solids and colloids in general. No standards must be prepared for use with this instrument. Detailed description of working principle and the instrument itself covered in Catalog 8000-A, available from Hellige, Inc., 877 Stewart Ave., Garden City, N. Y., or by checking handy coupon.

Painting Water Tanks For Longer Protection

52. High labor costs demand special consideration when painting elevated water tanks. This and other factors involved in proper paint selection are discussed in a bulletin issued by Jos. Dixon Crucible Co., Jersey City 3, N. J. Helpful specifications for repainting water tanks are also included. Check the coupon today.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

To Restore Capacity Of Water Lines

78. Water pipe cleaning service by hydraulic methods, power driven cleaners for scale and encrustation removal, plus relining of water mains are services offered by Ace Pipe Cleaning Contractors, Inc., 2003 Indiana Ave., Kansas City, Mo. For full description of these and other pipe cleaning services get the illustrated Ace catalog. Just check the coupon.

Reconditioning Pipe Lines With Cement-Mortar Linings

80. Pipe lines from 4 to 144 inches in diameter can be cement lined in place by the Centrline and Tate Processes. Catalog 9-52-5M describes how this operation gives new pipe line performance for a fraction of the cost of new pipe and shows how the work is done. Check coupon for your copy. Centrline Corporation, 140 Cedar St., New York 6, N. Y.

Specs for Gate Valves

112. Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 30"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Discussion of Ranney Method For Municipal Water Production

116. A very interesting study of municipal and industrial water supply problems and a complete discussion of Ranney Collectors for water production will be found in a 20-page booklet published by Ranney Method Water Supplies, Inc., Box 277, Columbus 9, Ohio. Water quality, construction methods, costs, performance and other topics are considered. Check the coupon to get your copy.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking coupon.



How MUD-JACK STABILIZES SUB-GRADES



Send for 20-page engineering handbook on Koehring Mud-Jack method

Koehring Mud-Jack® pumps inexpensive soil-cement slurry into small holes drilled thru pavement . . . raises the concrete slab, leaves firm, lasting sub-grade. Corrects grades of curbs, gutters, sidewalks, driveways. Two sizes: compact, portable No. 10 (illustrated) for city work, and bigger No. 50 Mud-Jack for preventive maintenance and low-cost repairs on highways.

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drills **6** inches of concrete per minute

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KONKRETE KORE DRILL**

Patented core slot expels cuttings automatically

Drill straight, clean, ready-to-use holes at speeds up to 6 inches per minute—even through steel reinforced concrete.

TILDEN Rotary Konkrete Kore Drills can be used with ordinary electric or rotary air drill. Free Factory sharpening and repair service still available on all Standard TILDEN Drills from 3/16" to 8-inch diameters. Interchangeable shanks for any depth hole.

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IN VIEW of the fact that density under a screed or tamper varies with the thickness of material above the high or low spots in the subgrade, and in the presence of large stones in the mix, any approach to securing absolute uniformity in the thickness of a road from subgrade to surface would be an approach to uniformity in density. Obviously uniform thickness is the result of accuracy in grading and accuracy in spreading.

Here, for the first time, is a real approach to the ideal conditions required for absolutely uniform density and uniform thickness with a truly level course the full width and length of any road, from subgrade to surface.

The Adnun with the Fluid Level is not just a Black Top Paver! Not just a Material Spreader! With the Fluid Level the Adnun is a complete Road Builder! The Fluid Level makes it possible to begin with your properly graded subgrade and lay the base course of any material to an absolute plane the full width and length of the road. Successive courses of

asphalt will be equally uniform. With uniformity of thickness in each successive course from subgrade to surface you have an approach to uniformity in density never before possible.

The Fluid Level takes out the dips that won't show under a straight edge. It brings long wheelbase results to an already compact, easily portable unit. It makes possible greater surface smoothness that results in better drainage and reduced breakdown. The possibility of holding error to within one or two per cent, means less waste of material and cuts costs to the taxpayer and the loss for the contractor. Investigate this method of building roads. It brings you a long sought answer to better built, lower cost roads that will go far toward meeting today's traffic problems.

Ask for the booklet, "Put A Level On Your Roads", for more details.

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This little booklet entitled, "Put A Level On Your Roads", tells you all about the Fluid Level. If you haven't seen it, send for it.

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How to Tap Concrete Pressure Pipe

126. The simple steps required in making a pressure tap in concrete pressure pipe are explained in a booklet issued by Lock Joint Pipe Company. Be sure you know how either large connections or small service outlets may be made economically and without sacrifice of strength. Just check the handy coupon. Lock Joint Pipe Co., Box 269, East Orange, N. J.

Faster Pipe Laying With Precast and Threaded Joints

148. McWane 2" cast iron water pipe with threaded joints and precast bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

Pipe-Laying Instruction Booklet Is Easy to Read

149. A new pipe-laying instruction booklet, written in straightforward language, explains every operation in laying concrete pressure pipe. "How-to" photographs and simplified diagrams show just how the job should be handled. Get copies of the 16-page booklet from Price Brothers Co., Dayton, Ohio, by checking the coupon.

Inserting Valves Without Shutdown

162. Do you have the latest data on equipment for inserting control valves where shutdown is impractical? Mueller catalogs H-20 and H-602 give all details on inserting valves and equipment, using hand-operated or power-operated machines. Get these catalogs today by checking the coupon. Mueller Co., Decatur, Ill.

Pipe Joint Essentials and Couplings for Every Job

168. Superior pipe joints are tight, flexible, simple, strong and economical. Dresser's handsome 34-page bulletin No. 513 shows how these essentials are met and provides layouts for curves, working pressures and a wealth of other data. Be sure to check this bulletin on the coupon. Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa.

Complete Catalog on Plumbing Drainage Products

169. Josam Catalog "K", said to be the most complete ever offered on plumbing drainage products, includes floor drains, roof drains, interceptors, sewer backwater valves, swimming pool fittings and many other specialties. Careful arrangement helps the designer find just what he wants. Your copy is waiting. Just check the coupon or write Josam Mfg. Co., Dept. X35, Michigan City, Ind.

All-Electric Floatless Liquid Level Control

174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletin for engineering data, diagrams of typical installations and details of component parts. Check the coupon or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

Avoid Needless Digging With This Valve Box Locator

178. Convenience and accuracy are keynotes of the Aqua Valve Box Locator described in a full color folder by Aqua Survey and Instrument Co., 2518 Leslie Ave., Cincinnati 12, Ohio. Cobalt alloy steel dipping needle is factory-set for any geographic location. Get full details by checking the coupon.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the coupon or write F. B. Leopold Co., Inc., Dept. PW, 2413 W. Carlson St., Pittsburgh 4, Pa.

Locate Pipes and Fittings Accurately

257. Save time and money with the precision Pathfinder detector for locating pipes, tees and valves. Powerful detecting unit tells you where to dig. For full details check coupon or write Pathfinder Co., 1726 Beverly Dr., Pasadena 7, Calif.

Critical Jobs Are Routine for Johnston Pumps!



TAKE BIOFILTRATION, FOR EXAMPLE...

Here are two Johnston Propeller Pumps recirculating effluent to the trickling filter and dosing tank at the rate of 2300 gallons per minute in a new sewage treatment plant in Jacksonville, Illinois. Normally these units operate individually but, when needed, both will run at the same time to take care of overloads or other emergencies.

There are many reasons why Johnston Pumps were selected for this job. Here are just three:

1. Equipped with stainless steel bowl shafting.

2. Removable aluminum-bronze bowl liner is not an extra-cost item—it's standard on a Johnston Propeller Pump.

3. Discharge elbow holds hydraulic losses to a minimum, while giving the user the advantages of economical construction.

This is another example of the ability of Johnston equipment to handle all kinds of pumping jobs. For the kind of pump "know-how" that puts money in the bank, see your Johnston Dealer, or ask a factory representative to call. They're always glad to help.



Send today for your free copy of "Flowing Power". Ask for Bulletin J-63.



JOHNSTON PUMP COMPANY

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Locate Mains and Services Without Digging

186. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes and valves by electronic means. Proper manipulation also determines depth of cover. Battery operated unit is readily carried by one man. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.

Installation Guide for Transite Pressure Pipe

192. A convenient, pocket-size book of 115 pages covers the whole job from receiving and handling pipe to pressure and leakage tests of finished lines. Over 100 drawings show important operations, and the text tells both how and why. Copies are available from John-Manville, Dept. PW, 22 E. 40th St., New York 16, N. Y.

Chlorination for Large and Small Pools

210. Dependable chlorination is a necessity for all swimming pools, no matter how large or small. You can find out just how to protect your pool in the most dependable and economical way by using the coupon or writing Wallace & Tiernan Co., Inc., Box 178, Newark 1, N. J.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

Are You Ready Now To Make Main Repairs?

214. Broken water mains can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Get Skinner Cata-

log 41 now—this handsome 40-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy. M. B. Skinner & Co., So. Bend 21, Ind.

Pre-Cast Filter Bottoms For Water Treatment Plants

217. Construction information on the Wheeler Filter Bottom, pre-cast type, for water treatment plants is offered by Builders-Providence, Inc., 345 Harris Ave., Providence 1, R. I. Illustrated Bulletin Sup. 700-K2 gives the details you need for planning and construction. Check the coupon for a copy.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in a convenient booklet offered with the compliments of U. S. Pipe and Foundry Co., Burlington, N. J. Get your copy by checking the coupon.

Handy Catalog Covers All Pipe Repairs

290. A complete catalog covering repair clamps, packings and gaskets of several designs to suit all needs is offered by Smith-Blair, Inc., So. San Francisco, Calif. Directions for use show ease of application. Every water works needs a copy of this catalog for ready reference. Available by using the coupon.

What You Should Know About Turbine Pumps

294. In a colorful bulletin titled "Water, Where You Want It . . . When You Want It" pumps with both semi-open and closed impellers: the Johnston Pump Co., 3272 Foothill Blvd., Pasadena 8, Calif., gives details on turbine

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity

ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check coupon for your copy.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., 208 So. La Salle St., Chicago 3, Ill.

Helpful Data On Pipe Tools

230. Toledo drop head ratchet threaders are light, compact, ideally suited for work in tight corners. Three models for $\frac{1}{8}$ " to $\frac{3}{4}$ " $\frac{1}{8}$ " to $1\frac{1}{2}$ " and $\frac{1}{2}$ " to 2" pipe all feature quick change of sizes. Get Catalog 11a52 from Toledo Pipe Threading Machine Co., Toledo, Ohio. Check the coupon.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5002 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the coupon for your copy.

STREETS AND HIGHWAYS

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and eco-

NEW IMPROVEMENTS
Cable Drum Clutch
Upper Arch Sheave
Automatic Cable
Level Wind

OK CHAMPION Power Sewer Cleaner

Twin rigs take debris from sewer to street in one operation.

Mounted on four wheel trucks—safer—eliminates lifting over or pulling away from manholes—safer tandem towing.

All Controls at Working End—keeps operator out of passing traffic—allows full vision of work.

Built-in Gear Reduction Ratio—allows better use of power for bucket travel.

Fully Automatic Safety Clutch—instant acting—avoids damage to tiles and machines.

Rely on the pioneer
manufacturer of power
sewer cleaners.

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CORPORATION**
Hammond,
Indiana

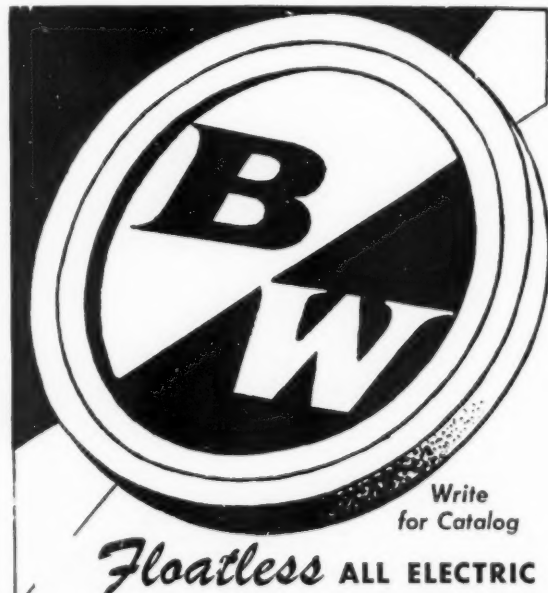


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Please send information on new OK Champion Power Sewer Cleaners.

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**For use with Bermico Sewer Pipe
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- Do a complete job with one top-quality pipe.
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- Meet any installation problem.



Bermico Tee



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AFTER INTENSIVE RESEARCH, Brown Company offers you a new line of Bermico Fittings that insure tight, accurate fits. Manufactured with scientific and technical skill, Bermico Fittings are root-proof, water-tight, resistant to acids and alkalis.

Like Bermico Pipe, Bermico Fittings are made from sturdy wood fibre, impregnated with pitch, and rigidly inspected. They easily meet all requirements of the National Bureau of Standards.

For detailed information and prices write Department BE-6, our Boston office.

*Still in the development stage and not available at this time.

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nomically without the usual cost of time-consuming reconstruction activities—a bulletin by Kuehling Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the coupon.

Get Data Now On This Catch Basin Cleaner

34. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. FW, Warren, Ohio.

Aerial Surveys and Maps from Photographs

229. Written in non-technical language, a 16-page booklet with this title gives a complete explanation of aerial surveys for the municipal field. Interesting step-by-step pictures show how planimetric and topographic maps, mosaics and atlas sheets are produced by Abrams Aerial Survey Corp., Lansing 1, Mich. Check the coupon for your copy.

Give Full Protection To Treated Poles and Timbers

267. Bolt holes in treated poles and timbers used for guard rails and structures can easily be the first point of decay. Now you can assure maximum life by using the Greenlee Bolt Hole Treater, a simple device that forces preservative into the wood cells. Bulletin 13-15 gives the details. Greenlee Bros. & Co., Rockford, Ill.

Black-Top Paver Offers Many Advantages

150. The flexible Adnurn Black Top Paver lays any asphalt mix, hot or cold, in widths from 6 ft. to 13 ft. Careful design lowers operating cost and cuts maintenance. Attachments spread stone, cinders or slag. Get full data on this machine by checking coupon. The Foote Co., 1954 State St., Nunda, N. Y.

End Manhole Rattle The Easy Way

184. It's easy to safeguard manholes and end annoying rattles by using Tapax, a wear-resisting, resilient manhole cushion available in convenient 100-ft. reels from Joseph G. Pollard Co., Inc., New Hyde Park, N. Y. Full details in Bulletin 14. Check the coupon.

Latest Data on Rubber Roads

296. A report covering all developments to date on the use of natural rubber in road surfacing of asphalt highways has been issued by the Natural Rubber Bureau, 1631 K St., N. W., Washington 6, D. C. Get your copy of this 52-page booklet which includes new data on research and full reports on test roads in many states. Use the handy coupon.



Wide World Photo

this could happen in your town

THIS CITY STREET CAVED IN when a water main broke. It's a dramatic, but not an unusual example of what water does to road bedding. Protect your roads and pipes from the problems of leakage by Centrilining. This patented process thoroughly cleans and centrifugally lines pipes with cement mortar. Leakage,

tuberculation and interior corrosion are permanently checked . . . carrying capacity and distribution pressure are increased to "better than new" highs. And the whole process is done with pipes in place . . . no excavation . . . no traffic disruption. With Centrilining you can save your water mains . . . and streets too.

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CEMENT-MORTAR LININGS FOR PIPES IN PLACE

3,000,000 FEET  OF EXPERIENCE

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BUSINESS AND ADMINISTRATION

Insurance Benefits For Civil Employees

73. Civilian government employees are offered insurance protection at the lowest possible cost by Government Employees Insurance Companies, Gov't Employees Insurance Bldg., Washington 5, D. C. Full details available by checking the coupon.

What Bonded Performance Can Do For You

121. On every construction job your city or county should be protected from a contractor's default or inability to perform the work. Learn what "Bonded Performance" can do for you. Write National Surety Corp., 4 Albany St., New York, N. Y., or check the coupon for full details.

Booklet Outlines Scheduled Preventive Maintenance

223. An interesting case history on reduction of equipment failures and less "downtime" through scheduled preventive maintenance is offered by Remington Rand Inc., Management Control Library, 315 Fourth Ave., New York 10, N. Y. Ask for Folder KD656 or check the handy coupon for your copy.

STREET LIGHTING

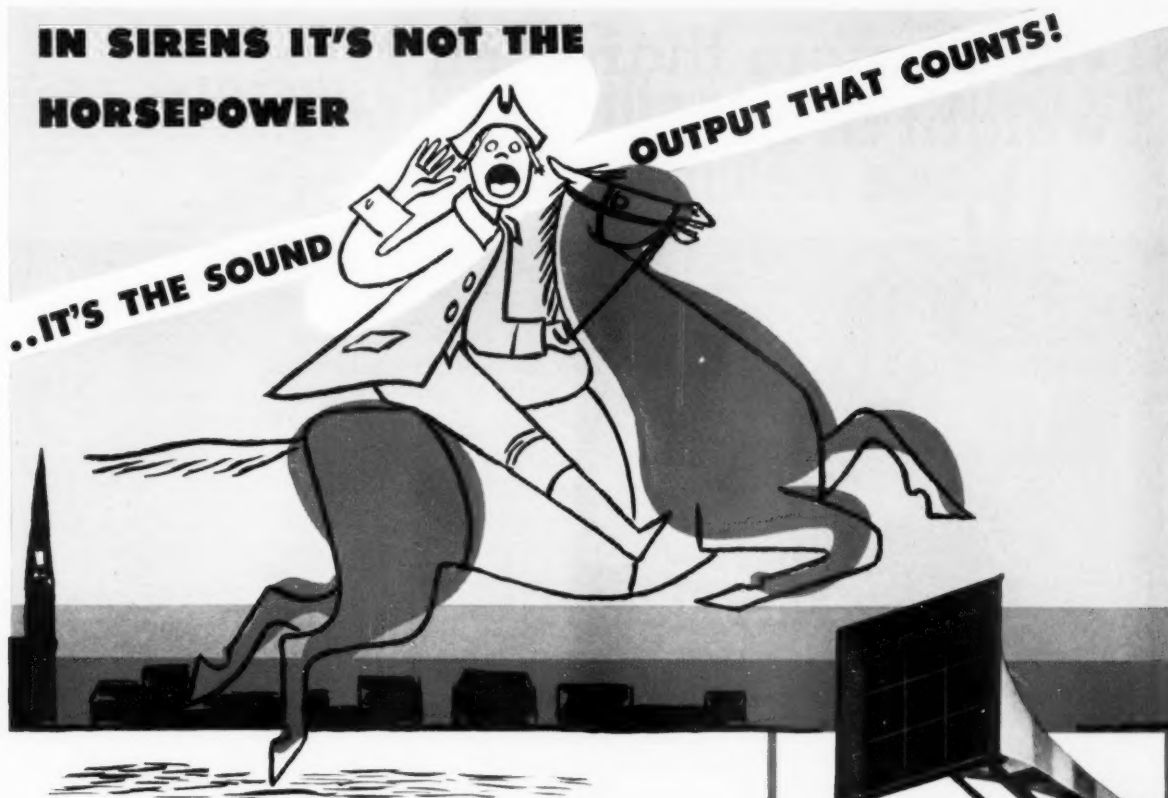
Mercury Vapor Lights Need Efficient Transformers

225. To get all the benefits of mercury vapor lamp illumination, efficient transformers are required. Complete data on Jefferson Transformers for all outdoor and indoor installations is offered in 16-page illustrated Bulletin 521-5 by Jefferson Electric Co., Bellwood, Ill. Particular attention is given to street lighting applications. Get a copy now by checking the coupon.

CONSTRUCTION EQUIPMENT AND MATERIALS

Handbook of Contractors Pumps Is Easy to Use

49. Big 50-page Catalog P-10 covers de-watering pumps, pressure pumps, well point systems and electric pumps, and also features a special section of useful data which helps in the selection of the right pump for your job. Every construction engineer and contractor should have a copy of this valuable handbook. Just check the coupon. The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.



When buying your vital airraid sirens, don't be beguiled by big horsepower figures. This one fact can save your community money and give proven greater sound coverage — the *Thunderbolt* does with 10 h.p. or less what others fail to do with 40 h.p. The Thunderbolt is supercharged for superior penetration and range.

What's more, only the Thunderbolt produces a full-volume of sound at low pitch as well as high!

Why is low horsepower consumption per unit of sound output so desirable? First, it is more easily adaptable to your existing power supply; that means lower installation costs. Also it permits wider selection of location . . . costs less to operate . . . cuts maintenance trouble and cost.

These reasons explain why the Federal Thunderbolt is the choice of the vast majority of *protected cities* . . . indeed over 200 cities boast that all or most of the units in their airraid systems are large and small FEDERAL Sirens.

Federal Sirens are the result of 50 years of superior engineering experience. Before you consider any siren, you owe it to your community to investigate Federal's complete line of sirens. Write Federal now for free information on planning your *better* airraid system.

FEDERAL THUNDERBOLT directional beam SIREN . . .

Rotates through full 360°. The Thunderbolt is mechanically and electrically simple, dependable and as trouble-free as conventional sirens. Both rotation and pitch are controllable. Height is optional within reasonable limits. Supercharger can be located inside, with the projector and rotator extending above roof if desired.

FEDERAL ENTERPRISES, Inc.

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82. Four models of "Quick-Way" truck shovels, $\frac{1}{4}$ to $\frac{1}{2}$ yd. capacity, and trench hoe, backhoe, crane, shovel, clamshell, pile driver or dragline attachments are ready to handle most every type of public works project. Get complete details by checking the coupon or write to "Quick-Way" Truck Shovel Co., Box 1800, Denver 1, Colo.

Inexpensive Ditcher Handles Heavy Digging

91. The Shawnee Scout Ditcher, a new, heavier model for extensive digging has been added to the Shawnee line of ditchers and dozers. All models are designed to handle ditching and backfilling operations quickly, efficiently and at low cost. Full information on this equipment will be sent by Shawnee Mfg. Co., 1947 N. Topeka, Topeka, Kansas. Just check the coupon.

Grading Can Be Faster, Cheaper and Easier

96. You'll like every feature of the Austin-Western 9911 Grader. It has all-wheel drive, all-wheel steer, controlled traction, precision sideshift and a high lift, extreme reach, reversible blade. Get data from Austin-Western Co., Aurora, Ill.

Examining a Tractor Piece by Piece

99. The 32-page catalog published by International Harvester Company should be studied by every tractor owner, for in it each unit from engine to track of the TD-9 Diesel is considered separately. These piece by piece discussions are supplemented by notes on easy servicing, versatile applications and attachments for every need. Get your copy of form CR 313-A from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check the handy coupon.

Save Excavating Costs By Boring for Pipe Installations

125. The Earthworm boring machine, a portable, compact unit for underground installation of pipe and conduit, is described in a bulletin available from Lube Jack Co., Box 1100, Santa Monica, Calif. Full operating instructions are included. Check the coupon for your copy.

Manual on Retaining Wall Design

160. Embankment stabilization with Armco Bin-Type Retaining Walls is discussed in a 16-page illustrated booklet offered by Armco Drainage and Metal Products, Inc., Middletown, Ohio. Included are case histories which show embankments along highways, lakes, streams and city streets. Technical data covers selection of design and units required for various sections, curves and grades. Use the handy coupon.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the coupon today.

Get Tough Blades and Cutting Edges For Your Construction Equipment

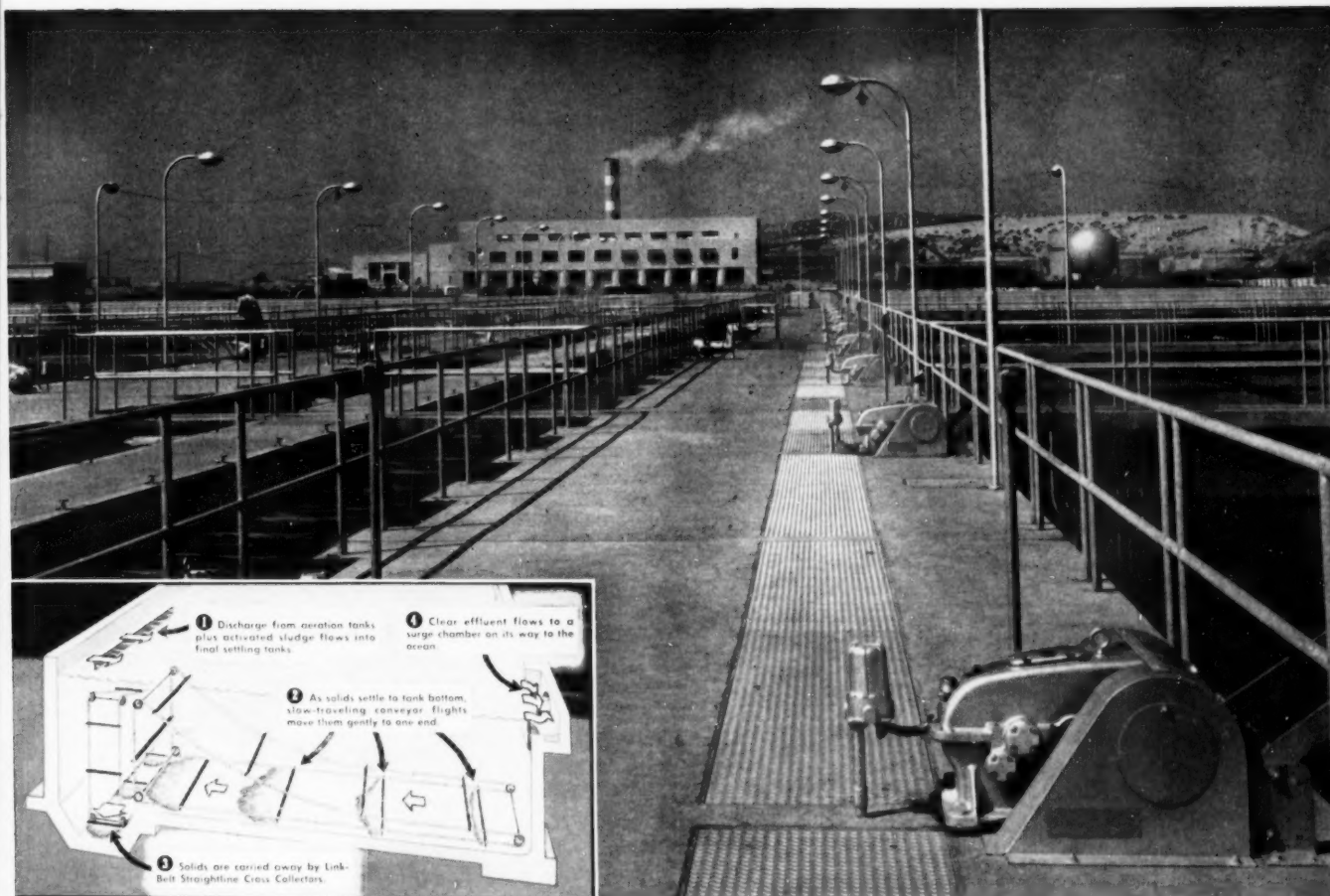
221. Controlled analysis steels used in Shunk blades and cutting edges for graders, scrapers, dozers, and snow plows mean long life and wear resistance to give you more value for your maintenance dollar. Full data for ordering blades and scarifier teeth for standard and special equipment is available from Shunk Mfg. Co., Bucyrus, Ohio. Check the coupon today.

Surveying Instruments—Basic Tools for the Engineer

228. Be sure you get Bulletin 1052 of David White Co. when you need transits, levels and other top quality surveyors gear. A full line of surveying instruments and accessories is described in their 42-page catalog. Get your copy by checking the coupon or write to David White Co., 315 W. Court St., Milwaukee 12, Wis.

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100 LINK-BELT Straightline sludge collectors serve Hyperion treatment plant



Los Angeles converts its sewage into fuel, fertilizer and clean water

FOR 10 years, the city of Los Angeles had 12 miles of beach quarantined. Then they decided to do something about it. They eliminated the source of pollution with the opening of the Hyperion activated sludge plant. Covering 75 acres, this modern plant is designed to serve 3,000,000 people.

Not only can Los Angeles now use its beaches, but the sludge gathered by the Link-Belt Straightline Collectors is converted into fertilizer. Gas, generated in the digestion tanks, fuels the power house. And the clarified water, now piped safely into the ocean a mile off shore, can some day be used for irrigation.

In hundreds of cities, large and small, Link-Belt equipment is used for the purification of water supply as well as for sewage treatment. And industry relies more and more on this equipment for salvaging valuable solids from waste . . . simultaneously preventing pollution of lakes and rivers.

Helping guard the nation's health is just one result of continuous Link-Belt research and engineering. In almost every industry, you'll find Link-Belt conveying, processing and power transmission machinery speeding production, cutting costs, making America better through greater productivity.

Storm peaks of 420,000,000 gallons per day can be treated at the \$41,000,000 Hyperion plant. Photo and schematic drawing show Link-Belt Straightline Collectors of which there are 100 in the final settling tanks. Plant designed under direction of Lloyd Aldrich, City Engineer, and Metcalf and Eddy of Boston.

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**Make Your Own Comparison—
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Jefferson has all the Vital Features**

Nine major design and construction features vital to top-flight transformer service, economy, and ideal lamp operation are listed below. Modern up-to-date Jefferson Transformers incorporate every one of these features to give you unmatched value in every detail.



Jefferson Transformers are quickly converted to pole-top units by adding Jefferson patented universal adaptors.

THE NINE MAJOR FEATURES	JEFFERSON TRANSFORMERS	Transformer A	Transformer B
① Press-fit riveted core	YES	YES	NO
② Leads stapled to core for positive strain relief	YES	NO	NO
③ Color coded and tagged leads	YES	NO	YES
④ Full sub-panel for rigid core and coil mounting with stamped lead designation	YES	YES	NO
⑤ Hot-dipped galvanizing on all outdoor types	YES	NO	NO
⑥ Deep Drawn cases on all outdoor types	YES	NO	NO
⑦ Solidly welded mounting bracket with locking holes plus key slot	YES	NO	NO
⑧ Universal Pole-Top Adaptor for 2 1/2"-4" O.D. Poles (a stock reducing feature)	YES	NO	NO
⑨ "Dura-Gray" harmonizing finish for modern, attractive installations	YES	NO	NO

For complete details and data on both outdoor and indoor type Jefferson Mercury Lamp Transformers, write for 16-page illustrated Bulletin 521-5. A copy is yours on request.

JEFFERSON ELECTRIC COMPANY
Bellwood, Illinois

JEFFERSON



TRANSFORMERS

Now's the time to mail this month's Readers' Service card.

Durable Gratings and Treads Are a Good Investment

147. Gratings for walks around settling tanks and other parts of treatment plants, both out-doors and in, for stairways, floors, and balconies, are described in an illustrated 16-page bulletin by Irving Subway Grating Co., 50-53 27th St., Long Island City 1, N. Y.

Your Property is Worth Good Protection

176. When installing link fence you want protection against rust and corrosion as well as vandalism. Investigate chain link fence made of "Konik" metal described in "Planned Protection" published by Continental Steel Corp., Kokomo, Ind.

A Helpful Booklet For Those Who Build and Maintain Roads

310. "Governmental Graders," a booklet published especially for the 18,000 governmental agencies with jurisdiction over local rural roads tells how the three sizes of "Cat" motor graders do the job on road building and maintenance programs. Of particular interest is a table of repair costs compiled from public records. Get your copy from the Caterpillar Tractor Co., Peoria 8, Ill., or by checking the coupon.

WEED CONTROL

Operations Manual Tells Brush and Weed Control Techniques

50. Data on methods and results in chemical brush and weed control are outlined in an operations manual compiled by the Du Pont Company. Included are cost data and evaluations of short-term vs. long-range control programs. Copies of this illustrated manual may be obtained from Grasselli Chemicals Dept., E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del., or by using coupon.

Chemical Weed Killers Are Fast and Effective

117. Be sure to check Polybor-Chlorate and concentrated Borasol for fast, economical non-selective destruction of weeds and grasses. Features and applications of these effective products are outlined in bulletins available from Pacific Coast Borax Co., 630 Shatto Pl., Los Angeles 5, Calif. Check coupon for full data.

What You Should Know About Chemical Weed Control

132. In a convenient 44-page book, the C. B. Dolge Co. gives full details on spraying procedures and chemicals to use for control of lawn and roadside weeds, ragweed eradication and insect control in turf. Get your copy by checking the coupon or write C. B. Dolge Co., Westport, Conn.

SIGNS AND TRAFFIC CONTROL

How Reflective Sheeting Improves Traffic Signs

157. Get full data on Grotelite reflective sheeting for smooth, brilliant, long-life traffic signs and marking devices from the Grote Mfg. Co., Bellevue, Ky. Use the handy card or coupon today.

CIVIL DEFENSE

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Enterprises, Inc., 8733 So. State St., Chicago, Ill., by using coupon.



...PAYLOADER PAYS...

EVERYBODY concerned is pleased with the back-filling job John Rooff & Sons' "PAYLOADER" tractor-shovel is doing on this 12" water main installation. The contractor likes the 500 feet of daily progress being made . . . the water department knows it is getting a good solid back-fill . . . the highway department is sure the "PAYLOADER" will not damage the pavement.

Dig! Load! Backfill! Stockpile! Lift! Carry! Strip! Push! Pull! The "PAYLOADER" does *all* these jobs. That is why it is one of the busiest machines on any project — and the most in demand. There are eight sizes of "PAYLOADERS," also a choice of four-wheel, rear-wheel or front-wheel drive to best fit your needs.

"PAYLOADER" Distributors — some 200-strong

in the U. S. and Canada — are ready to serve you with their modern parts department and service shops manned by experienced personnel. From ANY angle, it will pay to buy a "PAYLOADER" tractor-shovel — a *complete* unit built by the tractor-shovel pioneer, The Frank G. Hough Co., 761 Sunnyside Avenue, Libertyville, Illinois.

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Full information on any "PAYLOADER" model is yours on request:

Four-Wheel drive Models HM —

1 1/2 yd. and HR — 1 yd.;

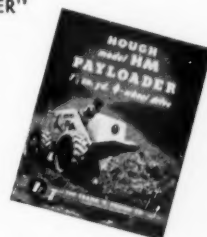
Rear-wheel drive Models HY —

1 1/4 yd., HFH — 1 1/8 yd.,

HF — 3/4 yd., HE — 1/2 yd.;

Front-wheel drive Models HAH —

1/2 cu. yd., HA — 12 cu. ft.





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until you have secured the latest information from



If you are charged with any responsibility for construction or maintenance of swimming pools in your community, then by all means you should write Josam for information on how to insure and maintain proper health standards, safety and hygienic conditions for bathers. Also how to provide a constant supply of clean water and how to secure maximum service from your pools — *before* you start construction.



"DOUBLE RECIRCULATION" TYPE POOLS

Josam offers complete information on recirculating type pools which provide double recirculation of water in a pool by water being drawn from the pool through the outlet drains, sterilized, filtered and returned through the Injector Supply at the same time that the water from the pool which enters the recirculating fittings at the bottom of the pool wall, is drawn through the line to the injector supply.



WATER LEVEL DECK POOLS

This new type of pool differs in construction and operation from the conventional side wall gutter pool. One of the most significant changes from the conventionally designed pool is the relocation of the overflow from the vertical side wall to a horizontal set back position under a slotted grille in the deck surrounding the pool.

This change permits the water in the pool to be maintained at approximately the same level as the surrounding decks and eliminates the use of steps and ladders . . . hence the name "Water Level Deck Swimming Pool."

Write today for complete information
on Swimming Pool Design and Fittings.

JOSAM MANUFACTURING CO.
Michigan City, Indiana

JOSAM MANUFACTURING CO., Dept. PW, Michigan City, Ind.

Please send complete information on:

☐ Recirculating Type Pools

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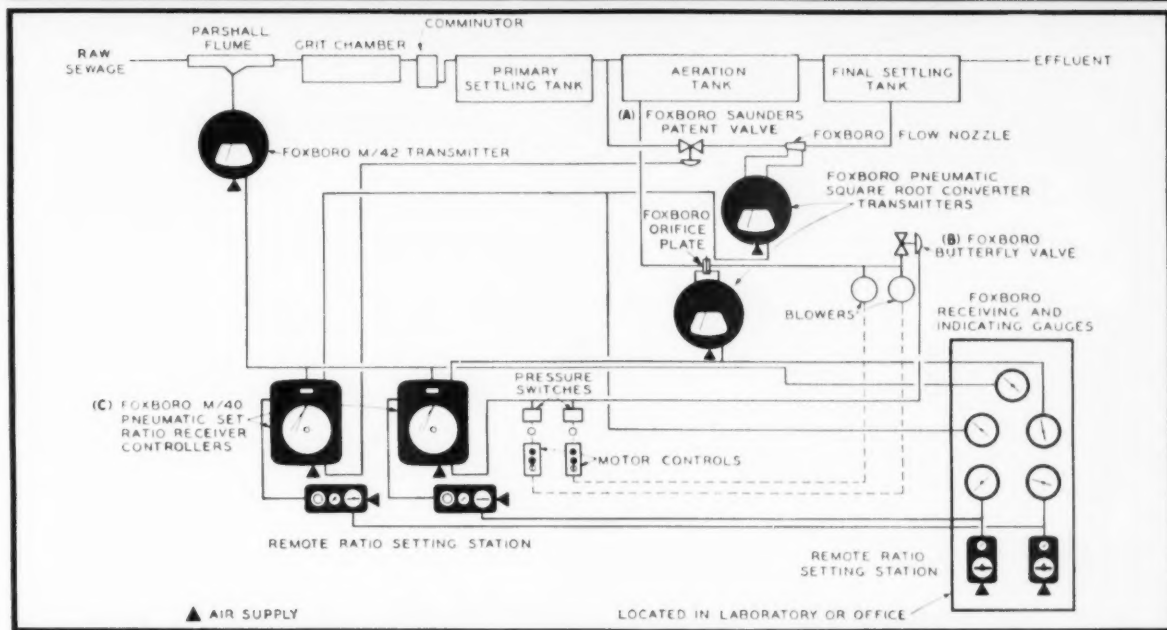
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How to reduce "Bulking" in your activated sludge process

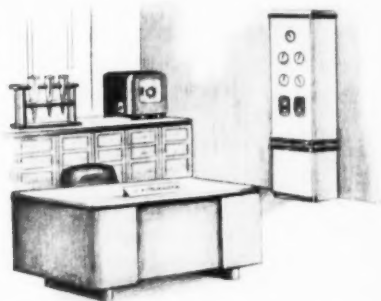


This FOXBORO system of aeration and return sludge control automatically maintains desired ratios of influent to air and to return sludge. You just set the selector switches at the proper ratios and Foxboro Controllers take over . . . no manual operation of valves . . . no need for 24-hour operational watches . . . less danger of "bulking" in final settling tank, regardless of variations in influent rate. Moreover, the Foxboro M/40 Ratio Receiver Controllers give you a permanent, continuous operational record for your files.

Why not learn more about this modern Foxboro Control System . . . write for Application Engineering Data Sheet 833-9.

The Foxboro Company,
266 Norfolk Street,
Foxboro, Mass., U.S.A.

Schematic diagram shows typical installation. Rate of return sludge is controlled by (A) Foxboro Pneumatically Operated Valve located downstream from a Foxboro Flow Nozzle. Air flow rate is controlled by (B) Foxboro Butterfly Valve on blower relief line with an orifice plate in discharge line. Both control valves are actuated by (C) Foxboro M/40 Receiver Controllers and provide a fixed ratio of influent to air and return sludge in the aeration tank.



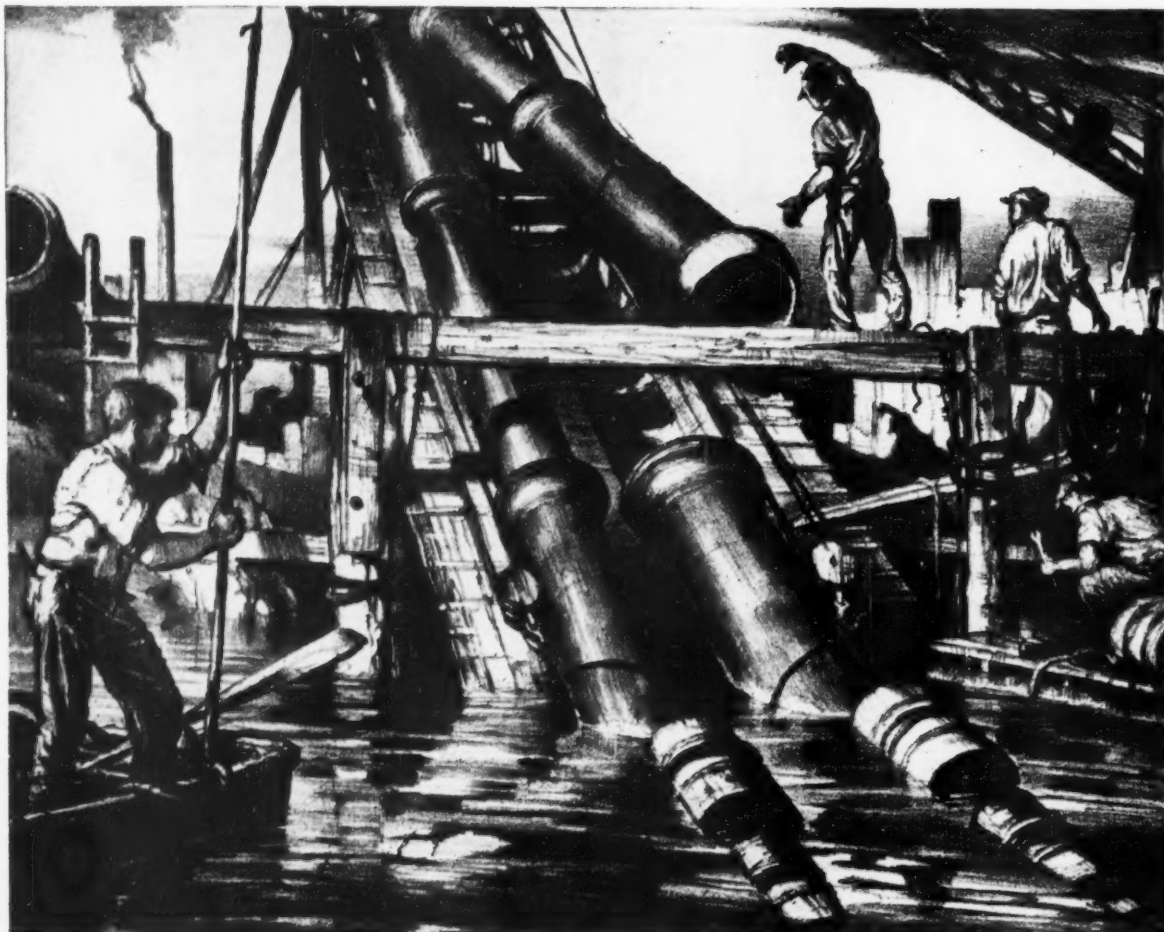
Remote setting stations can be located in laboratories or office so that Chemists or Superintendent may change the ratio setting without going to the main instrument cabinet.

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ACTIVATED SLUDGE CONTROL

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

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Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

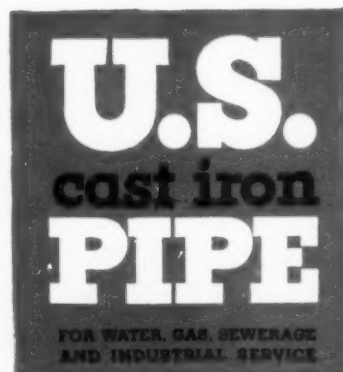
WHEN A CAST IRON water, gas or sewer line crosses a stream flexible joint pipe is frequently used. Joints that will deflect enough to meet installation and post-installation conditions and remain tight are most important in a submarine installation.

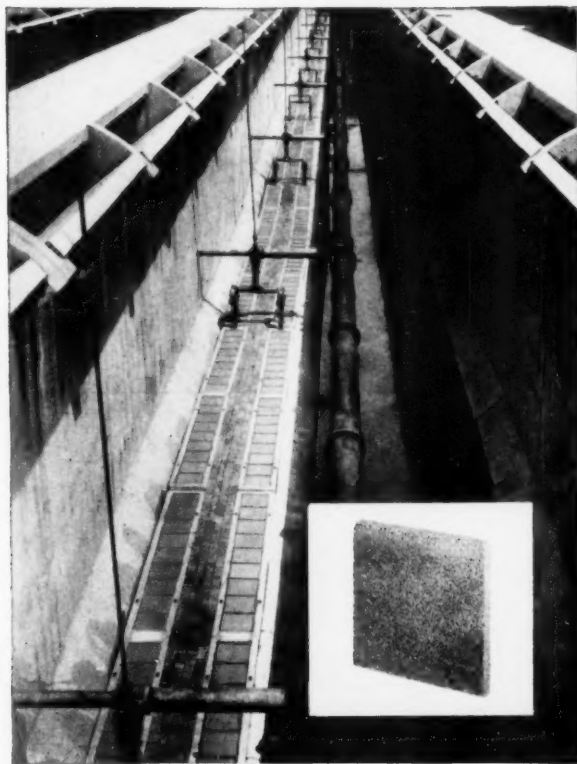
U. S. flexible joint pipe in all sizes, and pipe 30-inch and larger with other types of joints, are produced by the *pit cast* process. In sizes 2-inch through 24-inch, U. S. pipe is cast *centrifugally* in metal molds with bell-and-spigot, mechanical joint or plain ends.

Rigid quality controls are employed throughout the manufacture of all types of U. S. cast iron pipe from raw materials to finished products.

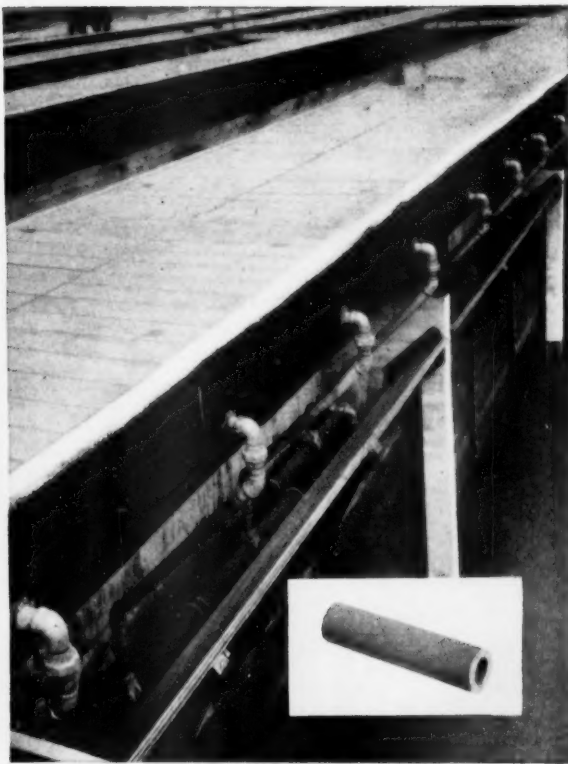
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Installation of Norton porous plates in a sewage disposal plant.



A method of suspending Norton porous tubes in a sewage disposal plant.

ONLY UNIFORM POROSITY MEANS UNIFORM AERATION... and you get it only in Norton ALUNDUM* Plates and Seamless Tubes

There's only one "controlled structure" process for making porous plates and seamless tubes — and that is the Norton process.

Experiments have shown that controlled pore size and distribution are necessary for uniform aeration.

Norton ALUNDUM Porous Mediums have this — plus the additional advantages of high resistance to both alkaline and acid conditions . . . to abrasion, breakage and chipping. They spell long, trouble-free life in activated sludge sewage plants. Plates,

tubes and discs are available in a wide range of sizes. Also available are plates for rapid sand filters in water filtration; seamless tubes for diatomaceous filters in swimming pools.

GET THE FACTS. Booklet contains charts, tables and other data pointing to greater efficiency and economy in porous mediums. Ask your Norton representative or write NORTON Co., 225 New Bond St., Worcester 6, Mass.



*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

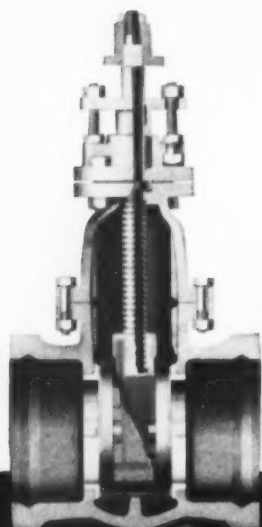
NORTON

POROUS MEDIUMS

Making better products . . . to make other products better

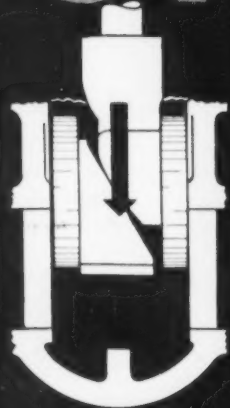
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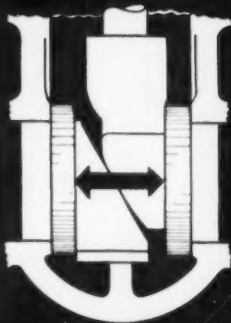


*Look how you gain
LONGER, TROUBLE-FREE VALVE LIFE*

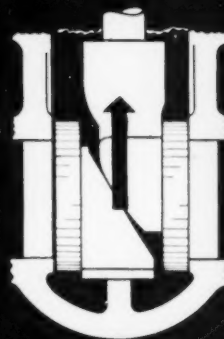
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revolving disc gate valves***



DESCENDING. Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for extra life!



CLOSED. Faces of upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressure and tight closing despite valve body distortion.



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These unique Darling valves are available in a broad range of sizes and types, manually or motor operated, for all normal or unusual services. Before you invest in *any* valves, find out what you stand to gain by using the proper Darling valves on your job. Simply outline your service needs for specific data . . . or . . .

ASK FOR BULLETIN No. 5002

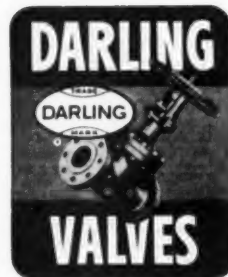
DARLING VALVE & MANUFACTURING CO.

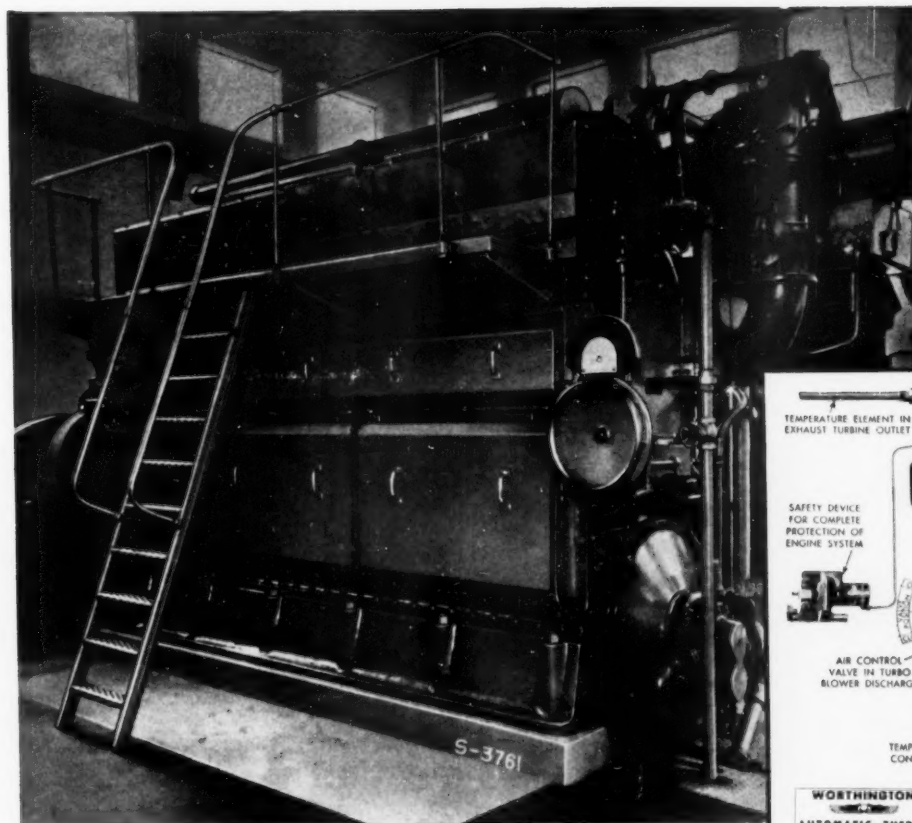
Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario

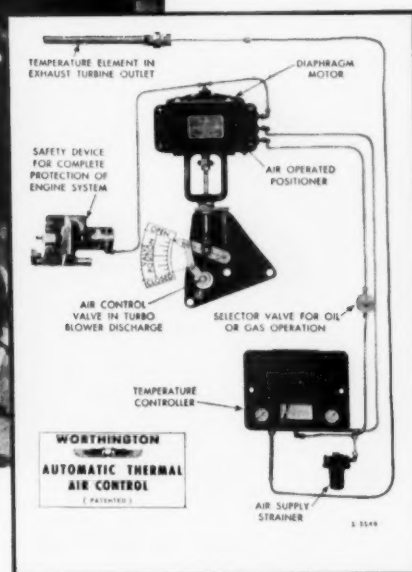
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HANDLING INCREASING LOADS at the Vermillion, S. D., municipal power plant is this Worthington converted 840-kw dual fuel Diesel engine.



WORTHINGTON AUTOMATIC THERMAL AIR CONTROL supplies correct air-fuel ratio to the engine cylinders at all times and in direct relation to all load changes.

Vermillion, South Dakota, meets new power demands

In 1949, the City of Vermillion, South Dakota, was faced with the necessity of meeting increased electrical load requirements on its municipal power plant.

To solve this problem, Vermillion plant engineers decided to have their Worthington EE-6 Diesel engine, installed in 1937, converted to a more powerful unit.

Worthington engineered the change-over of the 500-kw naturally aspirated oil Diesel to an 840-kw supercharged dual fuel Diesel—an increase of 340 kw. Engine speed was raised from 327 to 360 rpm.

Now, after a year and a half of heavy-duty operation, the Worthington converted engine has proved to be the most efficient and reliable power producer in the Vermillion plant.

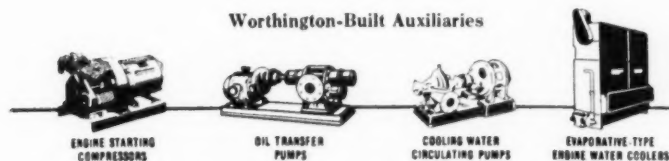
Four of the many exclusive Worthington features that insure top performance of Worthington dual fuel engines are:

1. Worthington automatic thermal air control for improved fuel economy.
2. Worthington dual plunger fuel pump for better, quieter combustion.
3. Worthington micro-metering gas valves—one for each cylinder—for equal cylinder loading and better speed regulation.
4. Worthington helical steel gear train for accurate and positive control of engine timing.

Worthington Corporation, Engine Division, Buffalo, New York.

E.2.5

Worthington-Built Auxiliaries

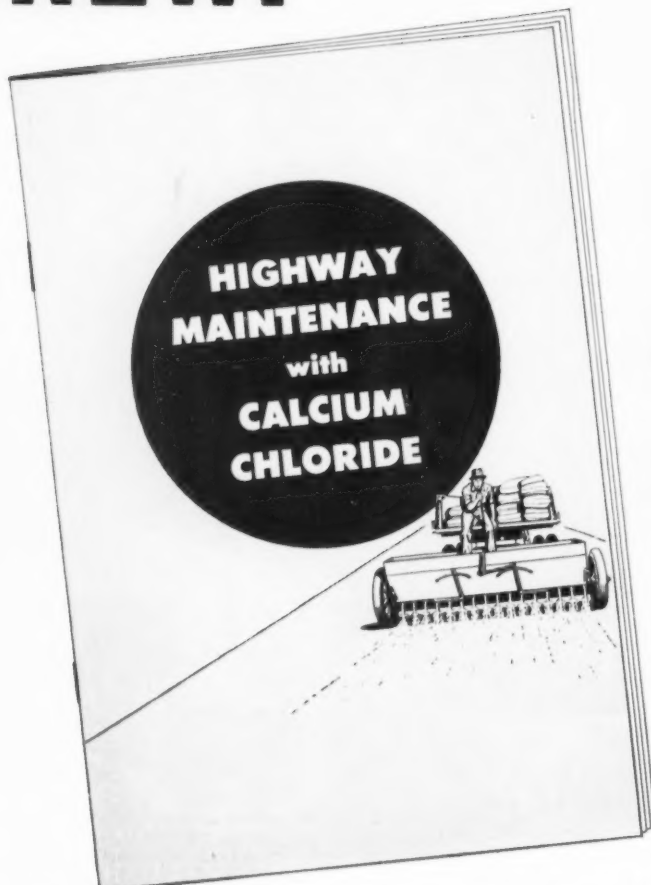


Economical Continuous Power—Diesels, Oil and Dual Fuel, and Spark-Ignition Gas Engines, from 150 to 2100 bhp.



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For Practical Highway Maintenance Men

New book gives proven practical suggestions for many troublesome maintenance problems, including:

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- shoulder maintenance
- blading and shaping
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- dustlaying

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Quick, Low-Cost Temporary Patching of Pavement: Tested methods and suggestions for easily and efficiently patching holes and breakups.

Speeding Up Permanent Patches for Concrete Pavements: Tells how it is possible to open permanently patched areas to traffic in $1/2$ the time!

This highly informative new booklet

was specifically prepared for practical highway maintenance men. It contains suggestions for the handling of numerous maintenance problems with recommendations, illustrations, tables and charts applicable to most maintenance operations. Contains special sections on summer, fall and winter highway maintenance.

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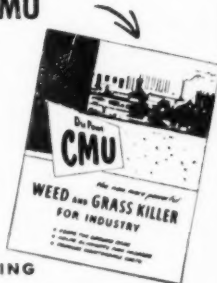
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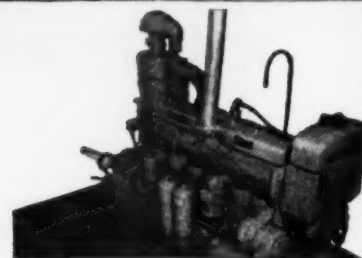
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Dependability and long life are built into every Cat unit through simplicity and honest ruggedness of construction. Chehalis also owns a Caterpillar No. 12 Motor Grader, and has found that standardization pays off in easier maintenance, in fast dealer service and a broad stock of genuine factory parts.

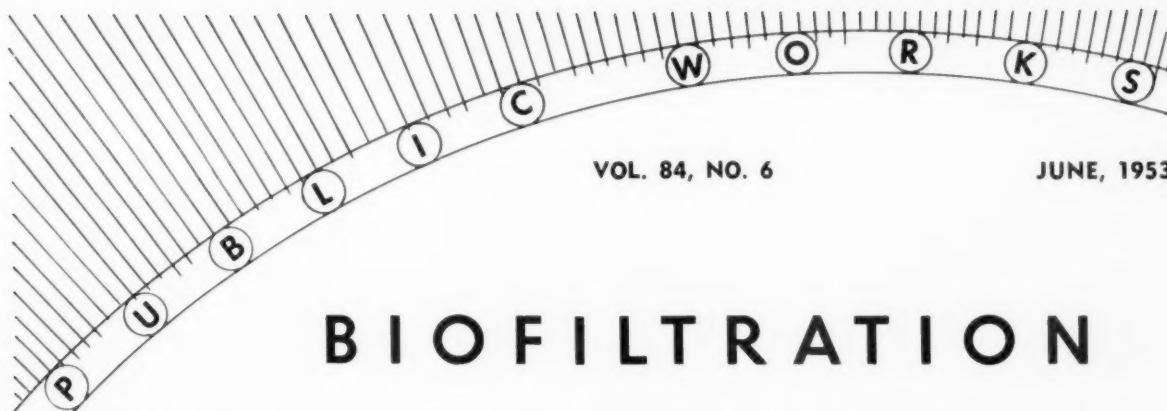
There are 12 engine sizes to 500 HP, and electric sets up to 315 KW. Talk over your power needs with your Caterpillar Dealer. He will be glad to *prove* Caterpillar's economy and reliability.

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R. S. RANKIN

The Dorr Co.

BIOFILTRATION has come of age as evidenced by over half a thousand sewage treatment plants which have been constructed over the world using this system of high-
 ance has been due largely to the fact rate filters. Its widespread accept-
 that more BOD can be removed from a given sewage per dollar of investment and per dollar of operating cost than by any other accepted method of biologic treatment. Biofiltration has the further advantage that it can be so designed as to produce any required degree of treatment between sedimentation and a well stabilized effluent.

Standard requirements for high-rate filters have been formulated by most of the state sanitary engineering divisions. Best known of these standards are those first adopted in 1944 jointly by nine states known as the "Upper Mississippi River Sanitation Agreement." This represents the first time that high-rate filters had received an official rating as to expected performance. Subsequent to the war and with the wealth of data contained in the NRC report on operation of military plants, further studies were made with the result that in 1951 new Tentative Standards were issued under the sponsorship of a Joint Committee composed of the Upper Mississippi River Board of Public Health Engineers and Great Lakes Board of Public Health Engineers, representing 10 States. The new standards for high-rate filters differ slightly from former standards and prove the soundness of the work of those who framed the 1944 Standards. Although only 10 States have formally adopted these standards, it is believed many others insist on compliance with them before approval of plans and specifications is forthcoming. In the

following discussion, the 1951 Tentative Standards are used when predicting filter performance. These standards give permissible loadings for various units including primary and final clarifiers as well as the filters.

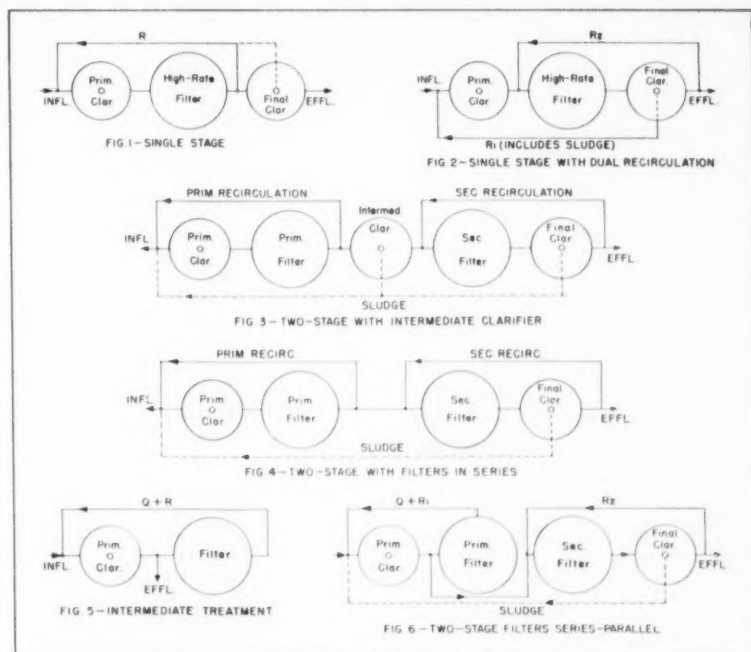
Flowsheets most generally used in Biofiltration are shown in Figs. 1 to 6. All of these flowsheets have been used in actual plants and each has merits which makes it most applicable for a given set of conditions. Fig. 1, single-stage; Fig. 2, single-stage with dual recirculation; and Fig. 3, two-stage series treatment with intermediate clarifier, are perhaps the most widely used flowsheets. The sheet shown in Fig. 4 has been used in areas of high summer and low winter loadings, operating as low rate filters in parallel during the winter. The performance

of each of these flowsheets may be analyzed and its performance predicted using Figs. 7 and 8, which have been derived from the 1951 Tentative Standards. Flowsheets shown in Figs. 5 and 6 also have a definite field of application and will be discussed later.

Predicting Results

Incidentally, though formulas are presented here which aim to predict the performance of high rate filter plants, it must not be construed that sewage treatment is an exact science. In sewage treatment a formula at best is only an approximation of conditions, but it does give a designer a starting point in selecting sizes of units for a given problem.

To make a proper analysis of a proposed flowsheet, it is essential to follow certain procedure. Usu-



● BIOFILTRATION flowsheets, Figs. 1 to 6, offer a variety of unit arrangements.



Courtesy Don Company

● SINGLE STAGE biofiltration plant at Port Washington, N. Y., treats 3 MGD.

ally a specific quality of effluent is desired from a given or assumed strength of raw sewage. One factor having considerable influence on filter performance is the recirculation ratio R , which is defined as the volume of flow recirculated divided by the average 24-hr raw sewage flow Q . Thus, if the raw sewage flow averages 1.5 mgd and recirculated flow is 2.00 mgd, the recirculation ratio is $2.00 \div 1.5$, or 1.33.

The beneficial effect of recirculation in reduction of BOD through a filter has been amply demonstrated in practice, but some still doubt that loading on a filter can be increased due to a recirculated load and yet a better final effluent can be produced than without recirculation. This effect can be demonstrated mathematically, again using the 1951 Tentative Standards, which requires that the organic content of the influent to the filter, recirculation included, does not exceed three times that of the effluent. Conversely, the effluent can be assumed to contain one-third of the filter load providing the loading is not excessive (4800 lbs./Ac.ft.).

Let F = filter load in lbs/day of BOD from primary clarifier

L = additional load in lbs/day of BOD recirculated flow

Then $F + L$ = Total filter load

And $\frac{F + L}{3}$ = settled filter effluent in lbs/day before recirculation take-off.

Then Final Effluent E , after recirculation take-off is

$$E = \frac{F + L}{3} - L$$

from which $E = \frac{F}{3} - \frac{2L}{3}$ which

is less by $\frac{2L}{3}$ lbs/day than a filter with

no recirculation. Continuous recycling of settled effluent does not introduce a circulation load.

In determining the recirculation ratio R in a single-stage plant it does not matter whether the recirculation is as shown in Fig. 1 or as in Fig. 2, but in the latter case R is the sum of R_1 and R_2 . Either flowsheet should yield the same final effluent, but each has advantage for specific conditions. When the recirculation includes underflow from the final clarifier and this is returned to the primary clarifier, it eliminates the need for a separate means of handling the humus sludge. Flowsheet Fig. 2 has this feature and by proper proportioning of R_1 and R_2 it is possible to make the final clarifier identical in size with the primary clarifier. Also, the final clarifier need not be sized to handle R_1 as this volume does not overflow the weir of this unit.

When R_1 is returned to the primary clarifier, the removal of BOD from the raw sewage by sedimentation should be estimated for design purposes independently of the effect of R_1 . The area of the primary clarifier is determined on the basis of total feed to the unit including recirculation. Return of a portion of the recirculated flow to the influent of the primary clarifier has in many instances proved very effective in odor control and in reducing scum. More of the scum seems to settle and become sludge, making for a plant much neater in appearance.

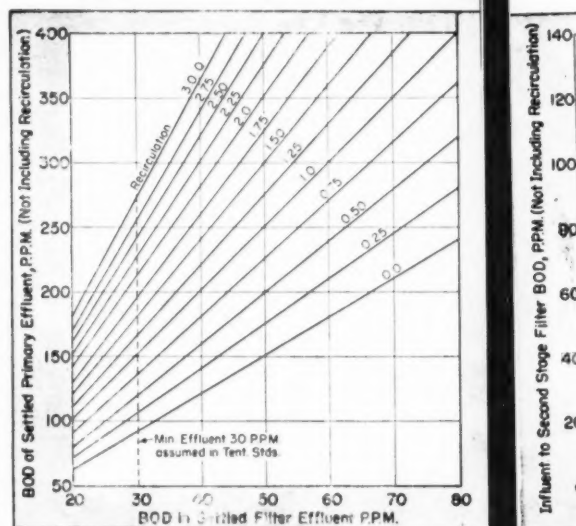
For two-stage plants with intermediate clarifier, Fig. 3, the expected performance for the first stage, is obtained from Fig. 7, and the result applied to Fig. 8 to determine the final effluent.

Determination of volume of filter media required in any high rate filter installation is usually done by

computing the total BOD in lbs. per day in the settled raw sewage, and using an accepted loading factor such as 3000 lbs. per acre ft. in the south, and 2000 to 2400 lbs. per acre ft. in the north, with no allowance for recirculated load. In two-stage plants the resulting volume is divided equally between primary and secondary filters.

Intermediate Treatment

Often it is unnecessary to go to complete treatment as given by a single stage complete treatment plant. Some intermediate degree of treatment between sedimentation and complete treatment may be entirely adequate for certain areas.



● FIG. 7. Expected performance of primary stage of high rate filters.

Fifteen years ago there were but two generally accepted degrees of treatment, primary and complete, with primary denoting simple sedimentation and complete denoting biologic treatment by low-rate filters or activated sludge, usually with a well nitrified effluent as the objective. For intermediate treatment, there was chemical precipitation and raw sewage flocculation either by mechanical paddles or by air. Neither, however, went far enough toward filling the gap between primary and complete treatment.

It has remained for high rate filters to fill the requirement for a method of treatment which can be designed to provide almost any degree of treatment between 60 and 90 to 95 percent removal of organic matter as measured by BOD and suspended solids. Numerous plants now in operation prove the feasi-

bility of designing a plant to meet a specific objective.

Assume a plant is being considered which is to turn out an effluent say with removal of 60% of the BOD and 70% or more of the suspended solids. This may be accomplished by using the flowsheet in Fig. 5. In this flowsheet the clarifier serves the combined function of primary and final sedimentation units with the effluent being a mixture of primary settled sewage and settled filter effluent. Using the formula developed from the 1951 Tentative Standards to determine the settled effluent of the filter with various recirculation ratios, combining this effluent in weighted pro-

raw flow per 24 hours), plus the recirculated flow R . This is essential in determining performance and can be explained by accepting the principle that the flow Q must pass through the filter before any recirculation can be established. Any flow through the filter in excess of the Q flow is considered recirculation. Thus where a value of R equal to 1.0 is used, total flow through filter is $Q + R$, or $2Q$, and the feed to the Clarifier is $3Q$.

It might be said that the effluent from a plant using this flowsheet contains a mixture of BOD from raw and treated sewage. This may be true but the usual objective of a treatment plant is to reduce BOD without regard to its nature or origin, and there is no means of determining the difference in BOD from a primary as compared to that from a settled filter effluent.

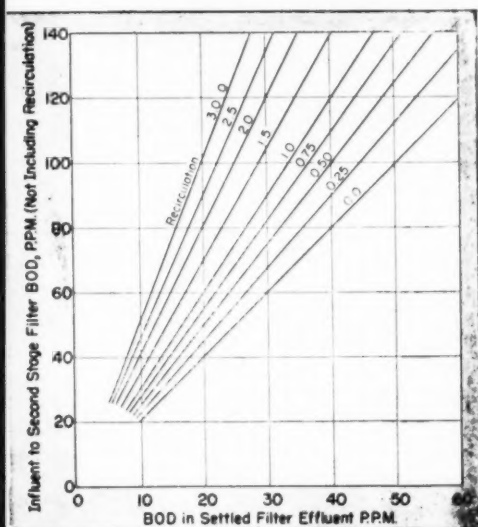
The size of the single clarifier is, of course, determined on the basis of the combined feed including recirculation. Overflow rates may be selected on the basis of the 1951 Tentative Standards which in general recommend around 800 gal. per day per sq. ft. of area. It is on this basis that one-third reduction of the BOD by sedimentation was assumed. A decrease in this overflow

rate is seldom economically justified, but it is occasionally desirable to increase it as, for example, when the effluent is further treated and this step constitutes only the primary or first stage. Often this flowsheet is used when treating strong sewages and it is necessary to go to two-stage filtration.

This flowsheet (Fig. 5) may be employed in the first stage of a two-stage plant with excellent results. The two-stage flowsheet referred to is shown in Fig. 6 which, it will be noted, employs no intermediate clarifier. The primary and final clarifiers are identical in size and the two filters are equal in area and depth of filter media. Thus, it is obviously an economical two-stage plant and it has the advantage of supplying a better food allowance to the second stage because some of the primary settled sewage is continuously fed to the second stage. This avoids the starvation diet for the bacterial growth on the second filter which is apparent in many plants having an intermediate or separate clarifier between the primary and secondary filter.

Analysis of the performance of a plant using this flowsheet is not difficult as it is necessary only to con-

(Continued on page 108)



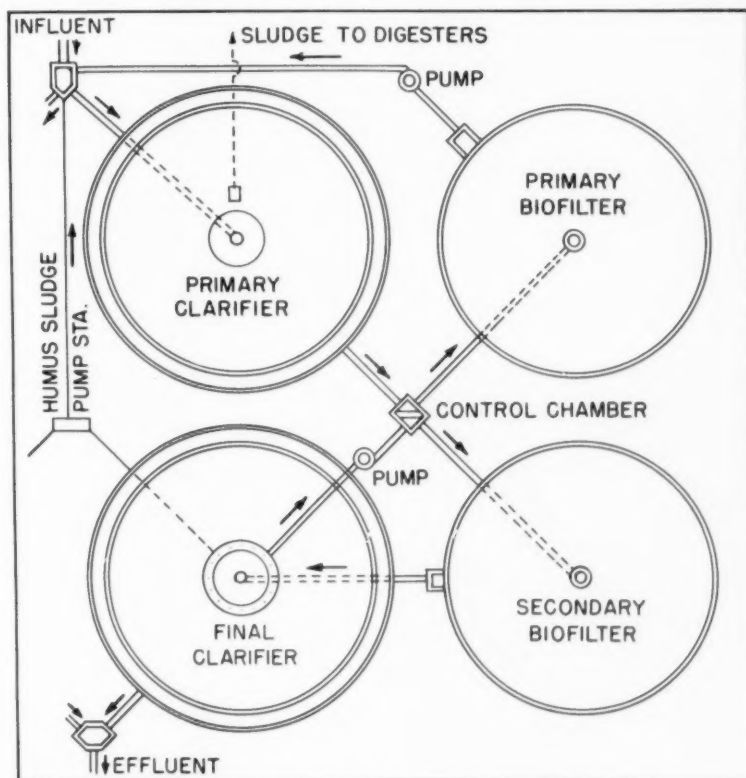
● FIG. 8. Expected performance of second stage of two-stage plant.

portions with the settled primary, it is possible to calculate the BOD of the mixture in the effluent. Repeated recycling of this effluent obviously lowers the BOD of the filter influent and consequently the filter effluent, but the effluent tends to stabilize after three or four passages. Assuming one-third (33%) of the BOD is removed by primary sedimentation, the overall BOD reduction using Flowsheet Fig. 5 will be approximately shown in Table 1.

TABLE 1—TREATMENT BY FLOWSHEET FIG. 5

Recirculation Ratio	Expected BOD Reduction Percent
R	
1.0	63
1.5	70
2.0	75

In this computation it is important to note that the total flow through the filter is the Q flow (average



● SIMPLIFIED arrangement showing piping for normal operation of Orlando plant.

DUAL CLAY SEWER CARRIES INDUSTRIAL WASTE

DAVID SKYLAR

MONSANTO, Illinois is a village, but no sleepy country settlement. It contains some of America's heaviest industries—and hence it puts unusual demands on its sewers. Most recent project at Monsanto is a twin industrial sewer which will serve the following companies: American Zinc, Darling Fertilizer, Lewin-Mathes, Monsanto Chemical, Midwest Rubber Reclaiming, and Socony-Vacuum.

The engineers for this work were Architectural Engineers, Inc., of East St. Louis, Illinois, with J. W. Goldenberg as consulting engineer on the project. Because the sewer line would carry acid and other chemical wastes, vitrified clay pipe was selected. There was a complicating factor, however. Clay pipe is made no larger than 36 inches diameter, and the volume of wastes to be carried here required a greater capacity. To overcome this, it was decided to build a dual 36-inch line.

The sewer runs for 1350 feet, through an area of very soft, sandy soil. Contractor Joseph P. Keeley of East St. Louis had to cut a trench from 18 to 22 feet deep, with wide sloping sides.

As a precaution against the pipe shifting during backfilling, and to care for the load due to the backfill, the pipes were encased in concrete. First step was to pour a reinforced concrete cradle at the



● WHITE DOT in pipe at right is light from the far end of the line and shows that the pipe was laid in excellent alinement and on smooth grade.

bottom of the trench. Parallel lines of clay pipe were laid on this cradle. Each section of pipe was anchored firmly in place with steel strapping hooked into steel eyes imbedded in the cradle. A precast concrete bulkhead was placed at every 15th section of pipe, to act as an end retaining wall for pouring concrete.

The contractor made short, frequent pours due to the possibility that rain might wash sand under the cradles and around the pipe, and

that this would be expensive to remove.

After the pipe joints had been made, steel reinforcing bars were installed between the two pipe lines, and along each side. Plywood forms were then erected to form retaining walls along the sides, and the concrete for the encasement was poured. Contractor Keeley used the same forms over and over by simply moving them intact along the line, with the aid of block and tackle.

CURB CURVES AT STREET CORNERS



● SIZE OF excavation required and two sewers are shown here.

A NEW method of designing the curves at curb intersections at street corners has been developed by studies conducted by the Department of Main Roads of New South Wales. In studying the problem the department used a double-deck bus with a wheel base of 17 ft. 6 in., overall length of 27 ft. 6 in., 8 ft. width and minimum turning radius of 40 ft.; and a passenger vehicle of 12-ft. wheel base, overall length 19 ft., width 6 ft., and minimum turning radius 28 ft. These were taken to represent the traffic where commercial vehicles form a large percentage of those turning; and also where such vehicles are unusual.

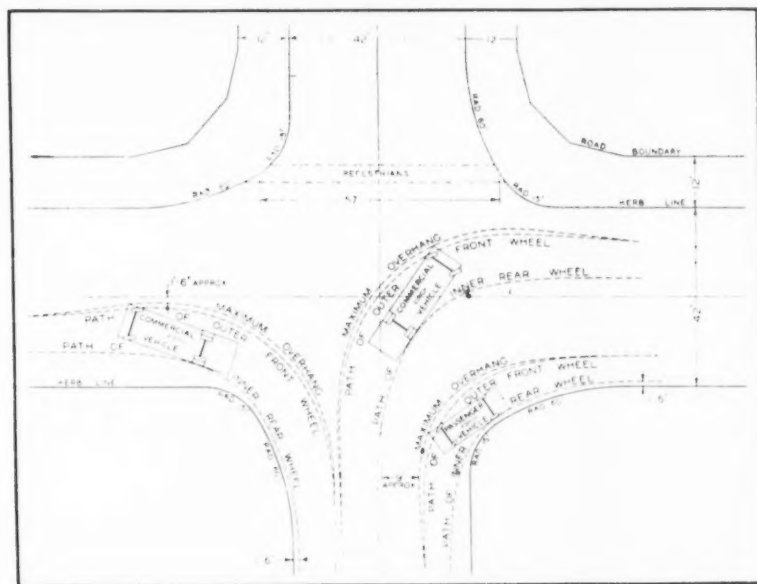
The principal factors considered were: (1) The shape of the curve should permit a vehicle of normal size to turn left (note that traffic there keeps to the left side of the street, not the right as in this country) within the path prescribed by traffic regulations and without encroaching upon the lanes provided for opposing traffic. (2) Sight distance at any point should be adequate for a driver approaching the intersection to see other traffic approaching in time to avoid a collision. (3) The passage of pedestrians across the road should be as short as possible and approximately at right angles to the general line of traffic flow.

The path traced by a commercial vehicle in turning a corner was found to be approximately lemniscate—a short-radius curve preceded by a relatively flat transition curve. Paths were plotted showing the traces of the front and rear wheels and maximum overhang when making such a turn. Buses travel near the curb to take on passengers, and in general vehicles intending to make a turn keep in the lane nearest the curb and therefore start the turning from the line of the curb as a tangent. It was found that a commercial vehicle could turn from a curb-side lane into the curb-side lane of an intersecting street in a simple curve of 50 ft. radius; or a three-centered compound curve of approximately 120 ft., 40 ft. and 120 ft. But in the first case the pedestrian crossing is 82 ft. from curb to curb of a 42-ft. roadway, and in the latter case 88 ft. To meet this objection, a two-center curve of 60-ft. and 15-ft.

radius was found to permit a commercial vehicle to turn from a curb-side lane to the second lane of the side street, giving a pedestrian crossing distance of 57 ft. Several corners in main roads in Sydney were built on this 60-15 plan and the traffic studied. This two-center curve proved so satisfactory that it has been adopted by the Dept. of Main Roads for intersections of two main roads, of a main road and a sub-arterial road, and a main road and a side street carrying bus traffic or largely truck traffic.

Where passenger vehicles are the basis of design, a 25-ft. radius curb will permit turning from curb-side lane to curb-side lane; and a 15-ft. radius from curb-side lane to the second lane on the side street.

The above is condensed from an article in "Main Roads", a quarterly publication of the Dept. of Main Roads of New South Wales, and in *Roads and Road Construction* of London, England.



● LEFT-hand traffic, but paths of vehicles making turns are shown clearly.

ALL-ELECTRIC PUMPING STATION for MEMPHIS

The new Thomas H. Allen Pumping Station of Memphis, Tenn., will increase the city's existing water supply by 50 per cent. Expected to be completed in 1953, the new all-electric station will supply 30,000,000 gallons of water a day. The General

Electric Company is supplying the major share of the electric equipment for the station which will hydraulically parallel the existing Parkway and Sheahan Stations, both steam-operated.

Since the water distribution sys-

tem of Memphis is a "closed" system with no elevated storage, the maintenance of adequate and even pressure necessitates continuous pumping at a rate equal to water use. Special emphasis, therefore, is placed on reliability of design in the electric system so that a continuous supply of electric power always will be available to keep the pumps in operation.

To prevent outages under normal emergencies, the pumping station will have four separate sources of power, three of which will be capable of handling the entire station load separately. Normally, power will be supplied through a single 12,000-volt line and cable from a nearby substation. Two additional 12,000-volt lines originating at a steam-driven generating station will furnish emergency circuits. A diesel-driven electric generator which can supply one-third of the station's power requirements will be available in the event all other sources fail. Suitable controls will transfer the station to emergency sources automatically.

Four G-E 600-hp wound-rotor motors will be used as prime movers for the De Laval pumps which will maintain a constant discharge head of 166 feet.

G-E 12-kv switchgear will be installed to handle the incoming 12,000-volt power supply lines. Two lineups of 2400-volt "double-bus-double-breaker" switchgear will be used to furnish power for the pump motors.

Except for emergency operation when the diesel generator is employed, the entire station can be operated from a benchboard in a centrally-located control room. This concentration of all controls will make it possible to operate the pumping section of the station with one operator per shift. Additional personnel for maintenance and emergencies will be required.

The benchboard will be divided into three functional sections with the left end controlling the well pumps, the right end controlling and providing supervision of the station valves, and the center section controlling the power sources and the station pump motors. In addition to pump motors, switchgear, and control, General Electric also is supplying a group control center and cam switches for the pumping station.

The Thomas H. Allen Pumping Station was designed by Black & Veatch, consulting engineers of Kansas City, Missouri, with electrical design by J. P. Kesler.

CREOSOTED

TIMBER BRIDGES

W. D. KEENEY

Engineer, Service Bureau
American Wood-Preservers' Association

BRIDGING on many county highway systems consumes a large proportion of available road funds, particularly in areas that are cut by many streams. With the limited budgets generally available, strict economy is necessary if suitable structures that can be maintained at low cost are to be provided for all the various classes of roads on a county system. The more important routes frequently carry traffic equal in weight and density to that using many of the State highways. Developments and frequent changes often bring large traffic increases, and bridges that have been adequate for roads with only light traffic must be strengthened or widened to meet these increases.

Creosoted timber is well adapted to short spans or to structures containing a series of ordinary trestle span lengths. Such structures are easily erected, can be widened or strengthened without difficulty, and are durable when properly designed and built with pressure-creosoted timber. Large numbers of such trestles have been built during the past 30 years by State, county, and Federal highway departments and for a much longer period by the railroads. Statistics collected recently on seventy of the large railway systems showed a total of 9,267,000 lin. ft., or 1,755 miles, of timber trestles. Many ballast deck creosoted timber trestles in place for 35 and 40 years are still in excellent condition, and good for additional years of service.

Harvey County, Kansas, though not one of the largest in area in that State, is a typical midwestern county with a progressive highway department that has a large number of bridges on its road system. The county is traversed by the Little Arkansas River and many large creeks tributary to it and to the Cottonwood River. The department has to deal with construction and maintenance of 423 bridges of over 20-ft. length on its rural roads.

This county for years has built treated timber bridges of various

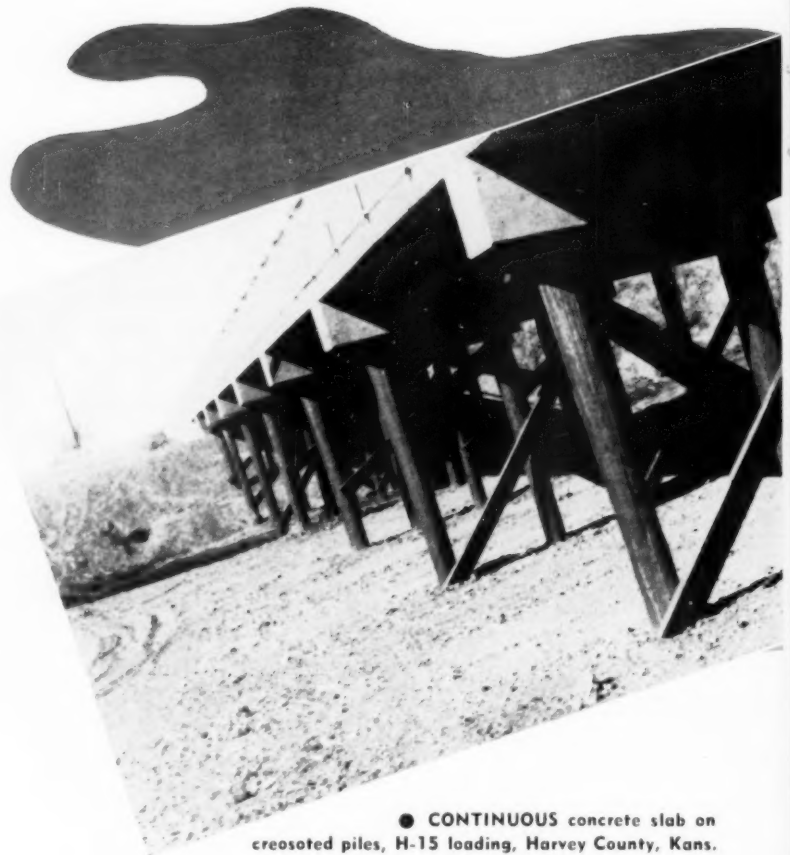
designs to fit the requirements of different sites. During the past year and a half, 18 new bridges of pressure-creosoted timber have been installed by the county bridge crews. For the most part, structures in this program have been of a standard pile trestle design with a deck of wood stringers and laminated floor. The largest of this type to be completed during this period was a crossing over West Emma Creek in Sedgwick Township, consisting of fourteen 19-ft. spans of 24-ft. roadway. This bridge was framed with 5-pile bents, 12 x 12-in. caps, 6 x 14-in. stringers and a 2 x 4-in. laminated floor. A bituminous mat was added to the 4-in. laminated floor as a wearing surface. A single low rail and a curb,

with 4 x 6-in. and 6 x 6-in. rail posts, completed the superstructure.

Composite Deck Construction


One of these newer bridges—that over Whitewater Creek in Pleasant Township—is a continuous composite treated timber-concrete deck structure. It contains nine 20-ft. spans supported on conventional pile bents, has a 24-ft. clear roadway, and is designed for the standard H-20 loading, since the road will carry heavy truck traffic.

The composite deck has been built by a number of State highway departments and others since this type was first installed during the early thirties. It consists of a laminated timber base of 2-in. plank on edge integrally connected to a



● CONTINUOUS concrete slab on creosoted piles, H-15 loading, Harvey County, Kans.

for COUNTY HIGHWAYS



in which the shear developers are seated. These are trapezoidal plates of 3/32-in. steel with 3 3/4-in. base, 1/2-in. point width, and 3 1/2-in. height. They are seated in slots cut in the grooves by a chisel blade shaped and stopped to cut the exact depth and size so that the base of the shear developer protrudes 1/2 in. above the high laminations for embedment in the concrete mat. Spacing of the shear developers in each groove depends on the live load shears developed. For usual highway loadings spacing varies from 10 or 12 in. near a support to 18 or 20 in.

In addition to the shear developers, 60d spikes are driven in each high lamination on about 4-ft. centers, their heads left protruding 1 1/4 in. to be encased in the concrete mat, binding the two materials together and preventing any tendency of the mat to curl under differential temperatures. The mat is reinforced throughout for temperature and shrinkage stresses, usually by 1/2-in. round bars on either 9 or 12-in. centers each way. Over interior supports, where negative moment

occurs, additional reinforcing is provided by placing a shorter bar between each longitudinal pair. The concrete mat usually is crowned from 4 in. at the curb to 4 1/2 in. at the center line.

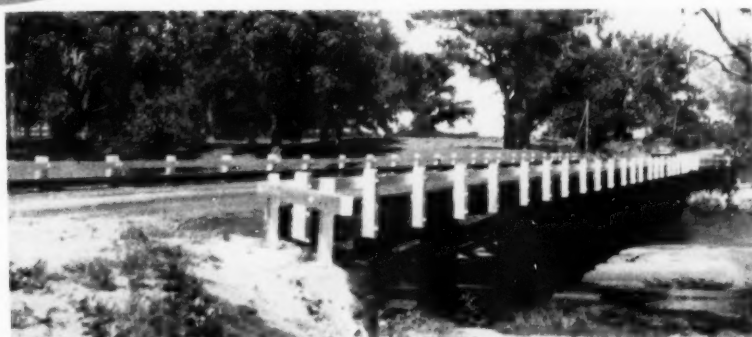
The recent program in Harvey County included a third or combination type of bridge which also required the use of pressure-treated wood piles. This structure was built by contract last year on a secondary road project in conjunction with the State Highway Department. It is in Macon Township across West Emma Creek and consists of nine 28-ft. continuous slab spans of H-15 design. The concrete deck is supported on creosoted pile bents, with concrete caps.

Longitudinal Laminated Deck

The longitudinal laminated timber deck also has been used by this and neighboring counties. The design is particularly adapted to roads with gravel, sand-clay, bituminous, or similar surface. A 4 to 6-in. thickness of the road material over the bridge gives continuity of surface, forms an effective wearing mat to protect the creosoted deck, and helps distribute the wheel load over wider areas. Because of its shallow depth, this type of deck is well suited to short spans and to sites where clearance is restricted. It is built from the cheaper grades and readily obtainable dimensions of lumber, and is easy to construct.

Span lengths range from 16 to 20 ft. in length. Decks of one and two-panel structures are built as simple spans, with all strips full

(Continued on page 118)



● AN 8-SPAN continuous longitudinal deck bridge in service since 1940.

concrete mat so that the assembly acts as a unit with an effective slab depth equal to the over-all thicknesses of the two materials. The base is made up of two heights of 2-in. plank on edge, spiked together to form a solid laminated slab. One-third of the strips are butt jointed at each interior bent and one-third at each quarter span point. Thus, all are continuous through midspan and two-thirds at quarter span points and supports. The two heights of plank are alternated to form longitudinal grooves



● CONCRETE deck on creosoted wood; seven 23-ft. spans with 22-ft. roadway.

HOW CITIES SAVE MONEY ON WATER SOFTENING

USE of automatically made Lixate brine to regenerate zeolite in municipal water softening systems has produced substantial savings for many municipalities by reducing the amount of salt used, eliminating dry salt spillage, and simplifying the entire process of handling and using salt and brine.

Lixate brine is neutral, being free from acids and alkalies. It is always fully saturated, crystal clear, ready for use. Made automatically in a Lixator, designed and engineered by the International Salt Company, it eliminates unnecessary salt handling, and reduces brine making to a simple, streamlined plant operation.

Essentially the Lixator consists of a storage hopper above a salt dissolving tank containing a salt filter bed and a brine collection chamber. Rock salt enters the dissolving tank by way of the hopper on top of the tank. As the salt already in the tank dissolves, additional salt automatically flows downward from the hopper to replace it. Below the top of the tank, water enters, its flow regulated by an automatic float valve; as it flows down, it dissolves the salt. Some distance from the bottom the brine becomes fully saturated, and the remaining rock salt acts as a filter, which removes all traces of suspended matter. When the brine reaches the brine collection chamber, it is crystal clear. From there it enters a brine storage tank, from which it is piped to the softener or to any part of the plant requiring it. Use of the Lixator thus eliminates the work of hauling dry salt from a storage pile to the water softening unit. Instead, the brine is piped to whatever point it is needed.

Reducing Salt Handling

Additional advantages of the Lixator arise from the fact that it and the rock salt storage pile can both be placed anywhere that results in most efficient use of available space. To minimize the amount

of handling of dry salt that is required, it is generally placed as close as possible to the point of salt entry into the plant. Sometimes the Lixator is located on the floor below the storage pile, so that salt flows into it by gravity. In other installations it is more convenient to place the unit next to the storage pile and fill the hopper either by shovel or by portable conveyor belt.

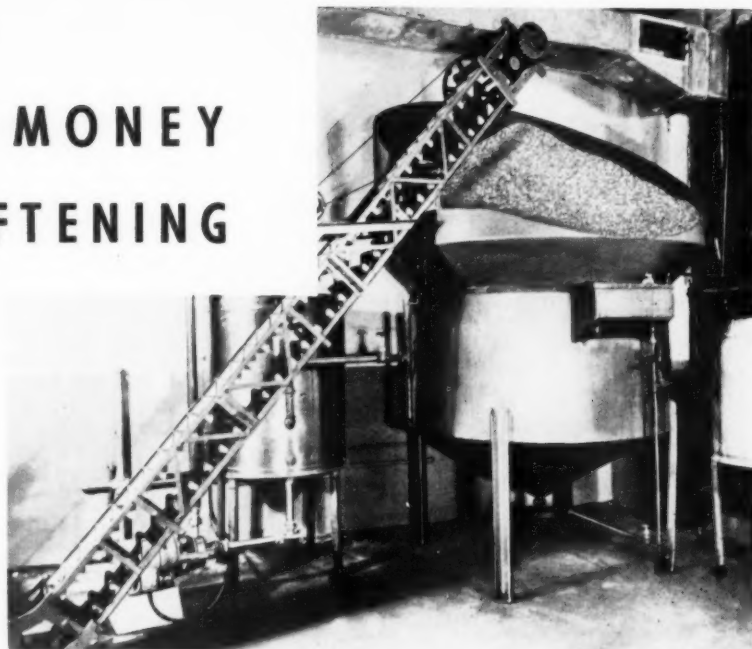
This equipment is made in a variety of sizes to meet the brine needs of individual plants, and units can be made as large or as small as necessary. In large municipal installations, storage type units are often used, because they make possible storage of carload lots of rock salt directly in the Lixator. No further handling or attention is required, because the rock salt dissolves automatically to produce brine as often and as fast as desired.

Operating Data

Operating instructions for water softeners call for the draw-off of a definite volume of brine for regenerating the zeolite, and this is supposed to be fully saturated brine. If it is not, it will not contain as much salt, and the regeneration will not be complete. This will lead to shorter runs between one regeneration and the next, more frequent regeneration, and greater salt consumption.

In addition to this, use of unsaturated brine produces another difficulty—in order to be safe the operator may draw off an excessive quantity of brine, and on the days when the brine is full strength, the extra draw-off represents waste of salt. Since Lixate brine is always fully saturated, this problem of waste does not arise.

Besides being fully saturated, brine prepared in this manner is also filtered and free from insolubles and foreign matter. For that reason it will not introduce dirt or other potentially clogging material into the zeolite bed.



● THIS PICTURE shows a Lixator equipped with a mechanical conveyor which fills the hopper with salt from a rock salt storage pile, as required.



● TYPICAL installation for a zeolite water softening plant.

WHAT NEXT



● SPRAY PLANE of Kern MAD, Bakersfield, Calif., applying EPN to cotton irrigation water.

FOR MOSQUITO CONTROL?

BEFORE DDT, there was no effective and economical way to kill adult mosquitoes in large areas out of doors. Now perhaps fifty million people are being protected by that chemical. It is a highly effective agent, but the problem of larva and adult resistance to DDT and of increasing resistance to other chlorinated hydrocarbons has led to continued testing of new and different chemicals, and to greater emphasis on sanitation measures coupled with insecticide treatments.

It's mostly the warm-weather areas of Florida and California that report partial or complete failure of DDT and some of the other chlorinated hydrocarbon insecticides to control mosquitoes. These two areas were also the first to report resistance among flies. Just how rapidly this mosquito resistance may show up in other parts of the country is a matter of conjecture.

Last year, however, a team of experts tackled the resistance problem in the San Joaquin Valley of California. Use of DDT and toxaphene at 10 to 15 times the normal dosage as field larvicides had failed to control predominant mosquito species—*Aedes nigromaculis* and *Culex tarsalis*. The latter is known to be the carrier or vector of a type of sleeping sickness (encephalitis). When cases of this disease started showing up in the lower San Joaquin Valley, fast action was needed. The California Bureau of Vector Control and the Kern Mosquito Abatement District joined forces.

Laboratory tests with an organic phosphorus compound—EPN insecticide—in Kern County, California, and Corvallis, Oregon, had already shown it to be the most toxic

material ever tested against mosquito larvae. The first California field tests were conducted by C. M. Gjullin, research worker with the U. S. Department of Agriculture. Just over half an ounce of active ingredient per acre achieved at 100 percent kill of *Culex tarsalis*, and a 99 percent kill of *Aedes nigromaculis* within 24 hours after application.

In these preliminary tests, both jeep-mounted spray rigs and low-flying airplanes were used. The jeep rigs applied the low dosages, (0.56 ounce of active ingredient per acre), using either a 45 percent emulsifiable oil concentrate mixture or a 25 percent wettable powder. With the

hours. The plane flew 90 miles an hour at a height of 25 to 50 feet.

In actual practice, the Kern Mosquito Abatement District, under management of Gordon F. Smith, began routine sprayings with EPN in June, using a plane and three jeeps, after the state had granted an experimental permit for the use of the insecticide. In July, 16 more jeeps were added to the crew, and EPN was applied to all mosquito breeding areas in the district with the exception of cities and towns, where the permit did not apply. The concentration used in these operations was at the level of one and one-fifth ounces (0.075 pound) active ingredient per acre.



● ENTOMOLOGIST for USDA applies EPN to Kern MAD test plot, using Jeep spray equipment—And what a test plot! This view shows the scope of the problem.

plane, EPN applied at the rate of about three-quarters of an ounce of active ingredient per acre, killed 96 percent of the *Culex* mosquitoes and 98 percent of the *Aedes* in 24

The jeeps delivered the material through a hand-held spray gun, using a #3 disc, and employing a gallons of spray solution were at pressure of 150 to 200 pounds. Ten

plied per acre. The plane delivered about 1.2 gallons of spray per acre.

This large-scale mosquito larva control program bore out under field conditions the early promise of the laboratory experiments. The success of this California work with EPN and other organic phosphorous compounds has attracted a good deal of attention among civic authorities and technical men who have responsibility for control.

There's no question about the effectiveness of EPN against larvae of DDT-resistant mosquitoes. It proved to be nearly 10 times as effective as either of the other two organic phosphorus compounds tested in the same experiments.

The safety factors in using such a highly toxic compound raise some questions—safety for the operators applying the spray; safety for people and livestock in the area treated—and the safety of water supplies which may be purposely or accidentally treated with EPN.

So far as the operators are concerned, the Du Pont Company, which manufactures EPN, recommends wearing goggles, respirator, rubber gloves and protective clothing—and, of course, avoiding unnecessary exposure to the compound. A simple medical test which a doctor can perform shows whether EPN exposure is becoming harmful.

So far as application is concerned, the most important safety precaution for the public works official is to be sure that the material is being applied under the supervision of people who are familiar with the use of such compounds. This also applies to safety measures for people and livestock in the treated area.

The Kern County tests were conducted in areas flooded by the Kern River, and in open water in irrigated pastures. Water depth ranged from one to 24 inches, and in most cases the surface was partially covered with grass. Cattle grazed one pasture which was sprayed six times at six to ten-day intervals with EPN without adverse effects being noted.

The use of any chemical for mosquito larva control raises the question of contamination of water supplies. Technical information on the toxicity of EPN has been widely circulated to states and federal experiment station investigators and public regulatory authorities. Each situation where EPN might be used should be considered on the basis of the specific circumstances, and competent advice should be sought.

Federal approval of EPN as a

mosquito larvicide has not been required for experiments to date, since they have all been under the supervision of legally qualified investigators. There will be more field tests on an experimental basis during 1953. Just how rapidly the insecticide is made available for commercial application or public control programs may depend on the increase noted in mosquito resistance throughout the country, coupled with results of further studies which are being carried on.

The U. S. Department of Agriculture has said: "It is not likely

that EPN formulations will be made available for individual use, but as more is learned about EPN, its use may be permitted in other areas of the United States by men trained in mosquito control techniques. Experience thus far indicates that it can be used without hazard if applied under the supervision of persons experienced in the use of mosquito control insecticides. EPN's effectiveness at extremely low dosages, is an important factor in its safe use, as only small amounts of the actual chemical are applied at a time."



● CHECKING mosquito larvae population, Kern Mosquito Abatement District.

Traffic Conference To Be Held At Purdue In June

A conference on Road and Street Traffic Control will be held at Purdue University, West Lafayette, Indiana, June 22-24, 1953. This will provide information on basic traffic control methods and techniques for city and county engineers.

Efficient use of traffic signals, signs, marking and channelization devices, and curb parking facilities, as well as state and local traffic control relations will be discussed. Speakers include K. B. Johns of the Kentucky Department of Highways; W. C. Milner and George L. Reymann of the Indiana State Highway Department; J. L. Lingo, Indiana Director of Traffic Safety; John H. Bunch and Paul Rice, Traffic Engineers of Fort Wayne and Evansville, Indiana, respectively; Floyd Kline of the Anderson, Indiana Police Department; and Professors R. B. Wiley, S. W. Gallien, and H. L. Michael of Purdue.

New Equipment Pays Off For a Water District

During the past year, the Augusta Water District, Augusta, Maine, S. S. Anthony, Superintendent and Engineer, purchased a truck-mounted backhoe for use in excavating trenches for water pipes. This has found many uses since, such as excavating for leaks, back-filling trenches and as a crane. A new rubber tired tractor with front end bucket for loading trucks, back-filling trenches and cleaning up surplus material left over after completing a job, was also purchased, replacing a smaller crawler mounted tractor with similar equipment which could not safely be used on asphalt streets.

Early in 1952, a system of short-wave two-way radio communication was installed in the office and three vehicles, resulting in much more rapid communication between office and vehicles and among vehicles with consequent better service to the public.

SEWAGE WORKS in CIVIL DEFENSE

SEWAGE works organizations should be prepared to meet any emergency arising from an enemy attack. They should be organized to make repairs quickly and effectively in order to restore service. This will require advance planning, an adequate supply of construction and operating equipment, an ample stock of repair materials, many trained repair crews and close coordination with the various other units of the local civil defense organization.

The Federal Civil Defense Administration suggests in its Administrative Guide that the engineering services chief of the local civil defense organization be responsible for coordinating the community's engineering resources into an operating staff covering essential services of the municipality. The Guide suggests that he appoint several assistants, each in charge of a different area of activity. One of the subdivisions should be the Sewage Works Service, which in time of disaster would be responsible for emergency repairs and operation of sewerage and sewage disposal facilities. Under this arrangement, the sewage works program will be planned by local sewage works officials, and the employees of the sewage works will form the nucleus of the sewage works services of the engineering division. Repair and operating crews will have to be augmented by volunteer workers.

Though the responsibility for restoration and operation of these services in emergencies remains with the municipal sewage works organization, this organization must be integrated for purposes of the emergency into the municipal civil defense organization. In developing civil defense organizations for sewage works, the cooperation of the state sanitary engineer should be obtained. In most cases, State sanitary engineers have become the only responsible state representative in this field. The position of the local health officer should also be recognized, preferably by appointing a member of the health

ARNOLD S. NESHEIM,

Sanitary Engineer,
Federal Civil Defense Administration,
Washington, D. C.

department to the staff of the chief of engineering services to assure cooperation between sewage works and health officials.

Sewage works officials and personnel should also maintain close liaison with other branches of the engineering division, particularly the water utility, but also with communications, transportation, warden, police and other civil

defense services. Only through such cooperation can effective civil defense be assured.

In a civil defense emergency, damage may exceed local capacity for restoration, so mutual aid among sewage works officials in the state should be given special attention. Complete information should be exchanged on the equipment, materials and supplies that can be made available in time of need. Sewage works organizations should be represented at the state level, preferably through the State Sanitary Engineers, so they will know what help they can expect from such sources.

The mutual aid program among

Sewage Facilities Advisory Panel

The members of the FDCA Sewage Facilities Advisory Panel reviewed the above material in its original form and made many suggestions for its more effective presentation.

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Los Angeles, Calif.

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sewage works can be expedited by meetings with representatives of other sewage works organizations in the mutual aid area. These men can acquaint each other with their respective emergency plans and can develop a better understanding of the assistance each can furnish. Assistance in this program can be developed at meetings of Sewage and Industrial Waste Associations, at State Sewage Works Operators' Training Schools and at meetings of Stream Pollution agencies.

sewage works would probably not be great.

Making a Survey

A pre-emergency study of the sewage collection and disposal facilities should be made to determine structural inadequacies or operational weaknesses and to analyze possible needs in personnel, equipment and supplies. A field study is desirable, using qualified personnel, with facilities for ample note-making, measuring and sketching.

Maps & Records.—Complete and

works organization may find that participation in the local police or fire department communications system will be feasible and satisfactory.

Headquarters and Field Offices.—

Consideration should be given to the need for decentralization through branch offices, which may be located at branch offices of the civil defense organization, or at storage yards, pumping stations or other facilities of the sewage works organization. Potential sites should be studied from the viewpoints of service to critical points, of accessibility to equipment and materials, of personnel needs, and of communications.

Sewer System.—Based on study of the maps and records and a field survey, the sewer system and its appurtenances — manholes, sewer lines, overflow chambers, by-passes and pumping stations—should be reviewed to determine what might happen and what steps would be possible to ameliorate the resulting damage. For instance, by-pass and overflow chambers might be possible points for emergency treatment or disposal; or short overflow lines from such structures or from manholes to nearby water courses might be desirable.

Other Facilities

Pumping Stations.—The capacity, pumping equipment and controls of all sewage pumping stations should be listed; the need for standby units determined, and the sizes and method of use of such units recorded. Floor plans should be prepared and detail drawings showing strength of beams, floors and other structural units should be checked. The need or field for use of portable pumping equipment, the provision of auxiliary power, possible replacement units, and alternate procedures for the disposal of the sewage handled by the station should be determined.

Supplies.—A complete inventory of available pipe, fittings, construction materials and construction equipment should be made. If an overall survey of construction equipment in the community has not been made by the civil defense organization, such a survey may be made. If such an overall survey has been made, steps to evaluate the needs of the sewage works organization for a portion of this equipment should be taken.

Sewage Treatment Plant.—In addition to the preparation of up-to-

(Continued on page 120)



Courtesy British Information Services

● **THIS PICTURE** of bomb damage to a London sewage pumping station shows what could happen to a vital utility in case of severe enemy attack.

If preparation is based on the most severe emergency, smaller emergencies will be handled easily. The atomic bomb is the most powerful weapon now available. "The Effects of Atomic Weapons"¹ gives information on the effects of an atomic bomb explosion on people and structures. The greatest above-ground structural damage occurs from an air burst, but this will not usually seriously damage underground structures, such as sewers. However, since precision in altitude may not be obtained, and close-to-the-ground blasts may occur, there may be serious underground utility damage; and in such cases, ground waves might destroy sewer and water lines for some distance. Other high explosive agents could be used in various forms, but would be less effective. Biological or chemical agents also might be used, but damage to, or difficulty in operating,

accurate records and maps of the sewer system are essential. These should show location of sewer lines and manholes, size and depth of sewers, and average and peak flows at important intersections. Areas drained by various main sewers should be clearly marked. Plans of the sewage treatment plant should be brought up to date. Equipment for the treatment plant and for pumping stations should be listed, with name, size and characteristic. It is desirable to duplicate the maps and store them in several locations.

Communications.—The facilities available for communications between headquarters, field offices, storage yards and the treatment plant, and the civil defense control centers should be studied. Needed improvements in communications should be analyzed and listed including the need for 2-way radio. In smaller communities, the sewage

BELT CONVEYORS HANDLE SEWAGE SLUDGE

VERSATILITY, ingenious material handling and automatic controls characterize the East Side Sewage Disposal plant put into operation some two years ago by Bridgeport, Conn. The plant, built at a cost of \$1,750,000, is designed to remove 60% of the suspended solids and grease from an average flow of 13 mgd with provisions for handling peak loads as high as 42 mgd. The settled solids are treated with ferric chloride and lime and filtered. The filter cake is burned to ash and used as fill. The liquid effluent is chlorinated during the summer months before being pumped into Bridgeport Harbor.

Both this plant and a similar but larger West Side plant handle domestic, industrial and storm sewage. Toxic metallic compounds, cyanides and aggressive industrial wastes amount to more than 60% of the total flow and make bacteriological treatment of the sewage impractical.

In the operation of the East Side plant, rags and grit are removed first. Then the sewage enters three 2-compartment settling tanks, 35 ft. wide, 195 ft. long and about 12 ft. deep which provide 3 hours settling time at average flow and 1 hour at the maximum. These tanks are equipped with Jeffrey sludge-collectors and scum and grease collectors. Suspended solids are reduced from 160 ppm to 64 ppm. The liquid effluent is treated with chlorine from May to September and is pumped into Long Island Sound.

The settled sludge passes into two storage tanks of 11,250 cu. ft. each where it is held for filtration. The plant operates its filters only three days per week for 15 hours per day. From the holding tanks, the sludge is elevated to the filtering floor by a special bucket elevator. Each bucket is 16 inches wide and contains 2 gallons of sludge. Ferric chloride and lime are added to the sludge in a mixing tank. The treated sludge then flows to 3 Conkey rotary filters built by General American Transportation Corporation. These have drums 8 ft. long and 6 ft. in diameter and operate at a vacuum of 25 in. of mercury.

The dried filter cake from the 3



● INCLINED BELT without skirt boards takes sludge cake to top of incinerator. Continuous belt travels 49 ft. at 26° incline and 16 ft. horizontally.

filters is discharged to the incinerator by a series of conveyor belts. A 24-in. wide endless conveyor belt supplied by the Thermoid Company, is 28 ft. long (center to center of pulleys) and operates horizontally at 60 fpm. Metal skirt boards with rubber guides at the bottom, near but not actually touching the belt, direct the filter cake to the belt center. This flat belt discharges through a chute to an inclined belt which takes the cake up at an angle of 28° to the top of the furnace. This also is a Thermoid belt, 24 inches wide and 46½ ft.

long which operates at 21.2 fpm. Because the flat sheets of cake are already consolidated in the middle of the belt, no skirt boards are required although the inclined belt operates flat. A weightometer supplied by the Sintering Machinery Corporation installed on the inclined belt automatically weighs the cake.

The belt delivers the cake to the top of a Nichols-Herreshoff Multi-Hearth furnace, the cake being fed to the furnace by a baffle-trap arrangement to prevent heat loss and damage to the belt. The incinerator

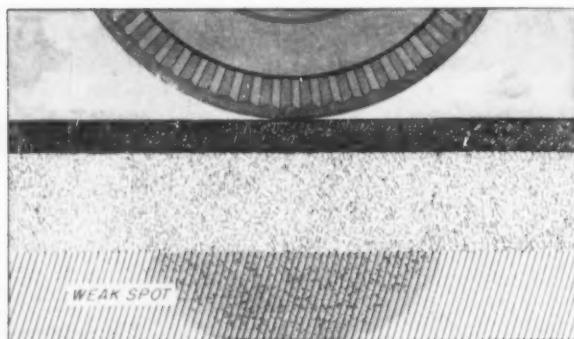
(Continued on page 136)

Patching Pavements *Properly*

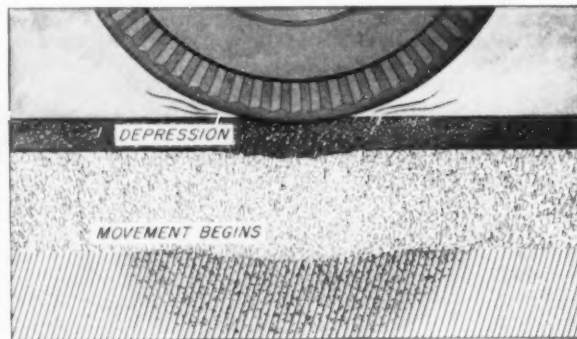
Prepared by **GEORGE E. MARTIN**, *Highway Consultant*

THERE IS probably no more widespread problem in the highway field than that of patching. No type of pavement is immune. If holes do not occur from natural causes, man-made service cuts and trenches will produce them. These defects vary from shallow abrasions to deep dangerous chasms and from small spots to extensive areas. It is no trouble to locate the holes. If the road official doesn't find them himself the public soon will and will let him know promptly and emphatically where they are. Then the question is—what to do and how. This we shall attempt to answer, briefly, but completely.

In doing this we shall first consider the general causes for failure and then the problem as it occurs in various pavement types. After that, the various materials and equipment used in patching will be described. Then the preparation for patching and, finally, the process of making the patch or other repair will be discussed in detail.



PAVEMENT IS STABLE but trouble is starting due to a weak spot in the subgrade which will cause movement soon.



DEPRESSION of the pavement occurs as the base settles into the weak subgrade and the pavement follows it down.



Courtesy Galion Iron Works Mfg. Co.

If the cause for the failure can be ascertained it is often possible to make a repair which is much more likely to be permanent. The best way to determine the cause is to inspect the break and observe the conditions in and around the hole.

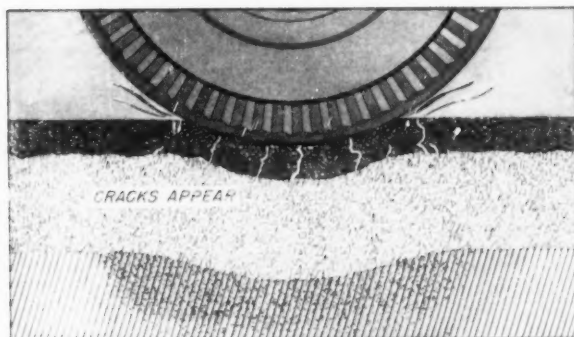
The most usual cause of failure is insufficient or unstable support. That is, the base material has, for some reason, failed to provide the strength to support the surface loading. This will be indicated by map or alligator cracking in the area ad-

jacent to the hole. These cracks are caused by the breaking of the pavement layer into comparatively small pieces by the action of traffic. As a wheel passes over the weak base the pavement is depressed; successive movements of this sort break the bond in the pavement; and cracks are formed. Additional traffic soon kicks one or more of the loose pieces out of the surface and a hole is produced.

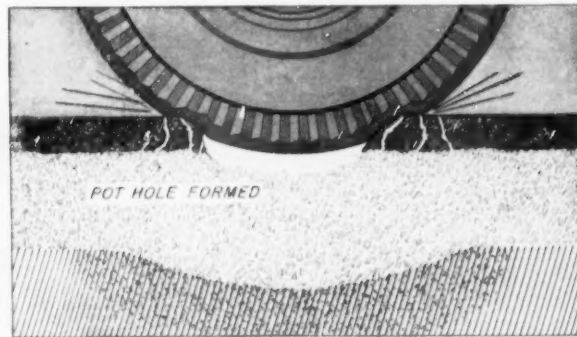
Poor drainage and entrapped water are often contributing factors. Conditions of this sort are definitely indicated when water is forced up

through openings in the pavement as traffic passes over it. Even when the road is dry, there is often a stain of clay or other material around the cracks showing that water has come through when the road was wet. Poor drainage is definitely a factor if free water is found in the hole to be patched.

The hole, or other broken or abraded area, may also occur due to some defect in the pavement itself. There are not many of these cases but they do happen. In a bituminous pavement that particular section may be lacking in binder. Bituminous concrete pavements are made in batches of a few tons each.



CRACKS APPEAR in the wearing course as the sinking of the base continues under steady pounding by vehicles.



POT HOLE has been formed when the loose pieces of pavement were thrown out by the action of traffic.



TYPICAL MAP CRACKING caused by movement underneath the pavement. The remedy is to strengthen the foundation.



POT HOLE FORMED as loose pieces of pavement have been thrown out by traffic. Cracks indicate weakness in base.

It is always possible for something to happen at the plant and insufficient binder be included in one or more batches. In bituminous surface treatments there may be a lack of bitumen due to momentary clogging of the nozzles on the distributing equipment. Of course, these things should be discovered and corrected at the time of construction but, if they are not, a hole, or at least an abraded area, is the result and this must be repaired.

All bituminous materials are affected by water, air and sunlight as they are exposed on the surface of the pavement. The materials tend to become hard and brittle in time and breaks or defective areas may be the result. Of course a particular hole may be caused by more than one of the factors listed.

In cement concrete the aggregate may swell and pop out. This is generally caused by chert and similar material. Modern specifications rule out such inferior aggregates but some of the older pavements, where they were used, must still be maintained. Much the same condition is true of the aggregates which react within the cement itself. All of these defects are self evident and easily determined by an inspection of the pavement.

Pumping of the concrete slab causes breaks which must be repaired. Heavy traffic over cement concrete which has been laid on

poor subgrade material, causes the slab to deflect and crack. Usually sections of this sort must be removed and replaced.

Bad drainage and insufficient support must be corrected when the repair is made. Patching without correcting these difficulties will only be a temporary relief. The area will soon break again and the patch must be replaced. How to do this will be discussed later.

Neglect may also cause trouble. If holes are not repaired when they are small, they soon grow big, and the amount of work to be done is greatly increased. If bituminous pavements are not sealed before they become dry and brittle on the surface, abraded areas and holes are bound to appear. If pumping cement concrete slabs are not supported with improved subgrade material, they will continue to break under

traffic, and the area to be replaced will be greatly increased. "A stitch in time saves nine" is an old saying, but still a good one.

Highway Types

Untreated Surfaces.—Holes in untreated surfaces such as gravel, stone and similar types are generally due to the displacement of the surfacing material by the action of traffic. They are most easily repaired by the addition of new surfacing material of the same kind as the original material used on the road. Sometimes an attempt will be made to do a better job by patching with a material or type superior to the original. To take an extreme example—patching a gravel road with bituminous or cement concrete. The gravel erodes around the patch and there are now two holes where there was but one before.



Courtesy Portland Cement Assn.

SOIL-CEMENT used to strengthen foundation. Patch matching existing pavement to be placed over new base.

PUBLIC WORKS for June, 1953

A gravel road is one of the easiest types to patch and will rarely require any preliminary preparation. Usually the gravel will be soft enough so that the new gravel can be spread over the hole and will amalgamate under traffic. Generally rolling is not necessary.

Traffic bound stone and slag roads made with small sized aggregate, usually containing no pieces larger than one inch, will act about like gravel and may be repaired in the same manner.

Waterbound macadam roads built of stone or slag, with pieces up to two or three inches in size, become very hard. Holes in pavements of this sort must be carefully prepared for patching. Detailed methods for preparing the hole and making the patch will be fully discussed on the following pages.

Surface Treated Roads.—Gravel, stone and similar surfaces which have been treated with bituminous material form sharp edged holes when they break and these are very objectionable to traffic. Such holes often occur when unsurfaced roads which have been quite satisfactory are treated for the first time. The untreated road permitted the water to evaporate through the top and the road remained fairly dry. The bituminous treatment sealed the surface and the water entrapped underneath the oiled layer weakened its support and it failed. If the breaks are numerous, and cover more than about twenty percent of the area, it will probably be necessary to rip up the crust, add new aggregate, mix, consolidate and do the treating job over again. If free water is present, indicating that poor drainage is a contributing cause, the drainage should be corrected before the surface layer is reworked. This may require deeper side ditches and perhaps additional drainage structures. One highway engineer when he saw these extensive breaks always said—"Its cheaper to scratch than to patch."

Holes in bituminous surface treatments can be patched by filling with fine grained bituminous concrete. Weak spots, which have not broken, but are evidenced by raveling, or map cracking, or both, can be strengthened by paint patching with bituminous material and aggregate cover on the surface.

Bituminous Macadam.—Holes in penetration bituminous macadam may be due to foundation difficulties or to the disintegration or drying out of the bituminous binder or seal

coat. Generally cracks will show in the pavement around the hole if the foundation is weak. Raveling and loose stones on the surface indicate that the binder may be at fault. If the binder can be easily chipped from the stones with a screw driver, or similar tool, its condition is at least a part of the difficulty. The holes are generally sharp edged and dangerous to traffic. The remedy is to strengthen the foundation, if necessary, and replace the broken section with a new bituminous penetration macadam patch or a bituminous concrete patch.

Road Mixes.—Road mixes can be classed generally as thick surface treatments or thin bituminous concretes. The causes of failure are the same as those given for bituminous macadam, plus the possibility of poor or insufficient mixing in the original construction, so that part of the aggregate is not well coated with bitumen. Holes are quite likely to be sharp edged and can be patched best with bituminous concrete. Abraded or cracked areas on the surface can be corrected by sealing with bituminous material covered with fine aggregate.

Bituminous Concrete.—Bituminous concrete surfaces may fail and break into holes due to insufficient foundation support or to some defect in the mix itself. For example the failed section may have been deficient in binder or may have had a poor gradation of the aggregate. Generally the repairs can be done best with additional bituminous concrete. Service cuts may require the replacement of a considerable area of the pavement due to the extent of the cut itself and to the fact that the pavement surface should be removed and replaced for a width



Courtesy Ingersoll Rand

PAVEMENT DIGGER operated pneumatically removing defective section. Other tools can be substituted for drilling, tamping, etc. Electric power tools are also used.

of about six inches on each side of the trench. Details of these operations will be given later.

Cement Concrete.—When holes in cement concrete pavements are not due to trenches or surface cuts, they are generally preceded by the raveling of the concrete surface. This may be due to defects in the concrete itself or in the aggregate used, as has been discussed under "causes." Usually these holes grow gradually and unless neglected too long are not very objectionable to traffic. Shattering or breaking of the concrete will cause holes or depressions in time. Either cement concrete or bituminous concrete can be used as the patching material.

The fact that holes and similar defects in cement concrete grow gradually makes it possible to delay repairs somewhat longer than is the case with many other road types. On the other hand even a minor abrasion in cement concrete will never heal itself as is sometimes the case in bituminous surfaces. Therefore the road should be repaired reasonably soon after the defects are discovered.

Block Pavements.—Few new block pavements are being built now but there is a very large yardage of existing block pavements which must be maintained. Stone block, asphalt block, wood block and brick pavements were constructed extensively, especially on city streets. Most of these block pavements had a bituminous or sand filler, except some of the brick which had a cement grout filler in the joints. Practically all of the block pavements were laid on a sand cushion which was from one to two inches thick.

Holes in block pavements are generally due to the failure of the foundation or the shifting of the sand cushion. In a few rare cases the blocks themselves are shattered. Except in the case of the cement grout filled brick pavements, it is good practice to remove the blocks and the sand cushion from the defective area and repair the

foundation, if necessary. A new sand cushion can be placed and the area repaved with good blocks. These may be new or reclaimed blocks of the same kind used in the original pavement. Joints are then filled with hot paving pitch or asphalt joint filler. These joint filling materials generally are shipped in light metal drums. The drums are cut apart with an axe or mattock and the chunks of filler placed in a kettle to be heated. Most

kettles are fired with a kerosene burner. The heat required for tar pitch will be about 350° F and for asphalt filler about 425° F. The hot joint filler is poured into the joints from hand pouring pots. A light covering with sand or pea gravel will prevent the filler from being picked up by traffic.

Cement grouted brick should be considered a rigid pavement and can be patched with cement concrete as described later.

Tools and Equipment for Patching

Practically all patching operations will require the use of the following hand tools even if the major operations are done by power equipment: Pick, broom, shovel, rake, bar and tamper.

Surface heaters and tool heaters are used for heating and drying holes, softening bituminous concrete, cleaning tools, etc. A blow torch is a handy tool to have available. A hand roller, such as a tennis court or lawn roller, is often used to assist in consolidation.

Power Equipment

Air Compressor.—A standard portable air compressor is needed for the operation of drills, pavement breakers, pavement cutters, pneumatic tampers, etc. A capacity of from 60 to 100 cubic feet of air per minute at a pressure of about 100 pounds per square inch will be required.

Pavement Breakers.—Most pavement breakers are pneumatically operated, although a few operate like a pile driver. The breaker is used to break out the cement concrete to be removed. They are also used to break the pavement into pieces small enough to handle.

Pavement Breaker.—Most pneumatically operated and is used to cut bituminous pavements. It works like a chisel.

Concrete Drill.—Most drills are operated by pneumatic power al-

though there are some that use electricity. The drills are used to make holes in cement concrete to outline the area to be removed. The concrete is then broken with a pavement breaker.

Concrete Saw.—These circular saws are commonly operated by small gasoline motors mounted as a part of the tool. Concrete saws are used to cut a groove in the top quarter depth of the concrete, on the perimeter of the section to be removed. A pavement breaker is then used to break out the cement concrete.

Loader.—A power loader is a handy tool for removing broken and defective material from large areas to be patched.

Tampers.—Mechanical tampers are of three general types—pneumatically operated, explosive and vibratory. The pneumatic tamper is like a hand tamper on a large scale. Tamping force is obtained by the action of compressed air moving a piston in a cylinder. The operator holds the tamper upright and moves it where needed and the machine does the rest. In the explosive type the entire machine bounds into the air and is guided by the operator. Tamping force is obtained by the weight of the machine falling from its top position, which is some distance above the pavement. The vibratory type is self contained having a tamping plate operated by a gasoline engine with an unbalanced fly wheel. Tubular vibrators are used to consolidate fresh concrete.

Rollers.—Small steel flat wheel, gasoline driven, rollers are made in two to five ton sizes especially for patching work. On large work the standard eight to ten ton sizes may be used. They are used to compact all types of patching mixtures except cement concrete. Pneumatic tired rollers have two rows of several tires each, mounted on



Courtesy Hough

POWER LOADERS are efficient and economical for loading discarded material.



Courtesy Tarrant Mfg. Co.

DRYER for heating and drying aggregate, sand and patching mixtures.



Courtesy K. E. McConaughay



Courtesy Barber-Greene Co.



Courtesy Kwik-Mix Co.



Courtesy Hetherington & Berner

PORTABLE MIXERS have been developed in the past few years especially for the production of bituminous concrete

for patching. Most of these mixers will manufacture either hot or cold mixes at the rate of about ten tons per hour.

axes, with a platform which can be loaded to produce additional weight. They are used to roll the covering material on paint patches, patches on untreated roads and, to a somewhat lesser extent, bituminous concrete patches.

Sweepers.—Both motor driven rotary sweepers and those which must be pulled are used to clean pavements preliminary to paint patching.

Blowers.—Blowers are used to supplement sweepers in the removal of fine material and dust prior to paint patching.

Bituminous Distributors.—Small distributors of about 600 gallons capacity are used generally for paint patches and penetration patches. The spray bars are often arranged so that a part of the bar can be closed off, and thus a narrow strip can be sprayed.

Cover Spreaders.—Mechanical cover spreaders distribute the covering aggregate uniformly over the road surface from the back of a truck. In some types, the cover is fed to a whirling disc and thrown from there to the road. Others feed the cover through rolls or in

some similar manner from the truck and it drops to the road. They are used in connection with paint patching and penetration patches.

Equipment for Making Patching Material

Concrete Mixers.—Concrete mixers are used to make portland cement concrete, soil-cement and bituminous cold mix. The smaller portable sizes, up to a cubic yard capacity are the most convenient. They usually have their own gasoline motor for power. Special equipment is available for making cement gunite.

Bituminous Mixers.—Several bituminous concrete mixing machines have been developed recently especially for the production of bituminous concrete for patching. They have their own gasoline power plant, heating equipment for the bitumen, measuring and mixing devices. They will produce up to ten tons per hour of either cold or hot mix bituminous concrete.

Dryers.—In order to make hot mix bituminous concrete, dry, hot aggregate is required. Small ag-

gregate dryers are being developed to meet this need. They are usually of the revolving drum type.

Heaters.—Gasoline heaters, essentially large or multiple blow torches, are used to heat aggregate and to heat and dry areas to be patched.

Heating Kettles.—Heating kettles are used to heat bituminous material for penetration patches and block pavement joint filler. They are usually kerosene fired and the more modern ones are built on the double boiler principle so that the temperature can be closely controlled.

Pouring Pots.—Hand pouring pots are used to distribute the bitumen for penetration patches and for filling the joints in block pavements.

Preparation for Patching

Shallow Breaks

Abraded or cracked areas on the surface of pavements rarely require any extensive preliminary preparation. Generally all that is needed is to remove the loose dust and other material from the defective area by sweeping or blowing or both.

For small areas the sweeping may be done with hand brooms. If there is much work to be done a power broom should be provided. The tendency is to make greater use of the motor driven brooms and reduce the hand work as much as possible.

An air blast will assist in cleaning the defective area. Compressed air, carried through a hose and nozzle, from an air compressor may be used, or a portable power blower will do the trick.

A bituminous paint patch with aggregate cover, as described later, will complete the job. Cement grout is sometimes used, similar to a paint patch on cement concrete and the proper procedure for that will be discussed under Rigid Pavements.

Pot Holes

Holes up to about two feet in diameter in pavements are commonly called pot holes. They are rarely less than one inch in depth and may be six inches or more deep, depending upon the strength of the pavement, the kind and amount of traffic, the weather, and the length of time since the hole first started.

Very small holes, less than three inches in diameter, need little or no preliminary preparation before patching. Loose material should be removed from the hole by a shovel or other convenient means. This operation may disclose that the area adjacent to the existing hole is weak and the defective material must then be removed and the hole treated as a large one.

Larger pot holes need more extensive preliminary preparation. All loose material must be removed from the hole with shovels or by any other convenient manner. The bottom of the hole should be excavated until solid material is reached. This will require the use of picks or bars to assist in loosening the partially consolidated material. If the pavement is one of the flexible types the edges of the pavement surrounding the hole should be cut to a vertical face. The hole itself should be excavated so as to be approximately a rectangle in plan. Here again picks and bars will be used generally, but pneumatically operated pavement cutters are very handy tools if the job is large enough to justify their use. Care must be taken to see that all of the defective pavement area is removed. When in doubt it is good practice to remove a little more so as to be sure to have a solid face to support the edges of the patch. Holes

in rigid pavements are prepared by outlining the area to be patched by boring holes on four to six inch centers, breaking out the included pavement area with pavement breakers and removing the broken pieces. In place of the series of holes, a concrete saw may be used to cut a groove through the top one quarter of the depth of the cement concrete slab. Pavement breakers are used to break out the enclosed defective pavement as before.

Very large areas, several feet in size, are prepared for patching in

defective material from the existing pavement. Be sure that you have provided a straight, vertical edge in the old pavement all around the perimeter of the area to be patched.

Service Cuts and Trenches

While city pavements are more likely to be cut to install service connections, and to repair water mains, sewers and other sub-surface installations, cuts and trenches are common to all highways.

The cut through a flexible pavement may be made by hand with picks, bars and shovels or may be



Courtesy Clipper Mfg. Co.

CONCRETE SAWS cut through the top one quarter of cement concrete on the perimeter of the section to be removed and permit a neat joint finish.

much the same manner except that mechanical equipment can be used to much greater advantage. Saws cut out the area. Pavement breakers reduce the pavement to pieces small enough for the equipment to handle. Mechanical loaders then take over and remove the loose pieces from the area to be patched. This material may be used to strengthen the foundations or may be hauled away to be used at other locations where work is being done.

Some pick and shovel work will be required thoroughly to clean the area to be patched. The same rules apply as for the preparation of the smaller holes, namely—be sure that you have excavated down to the point where the foundation is solid or at least far enough so that you will have sufficient depth to build a new solid foundation. Be sure that you have removed all of the

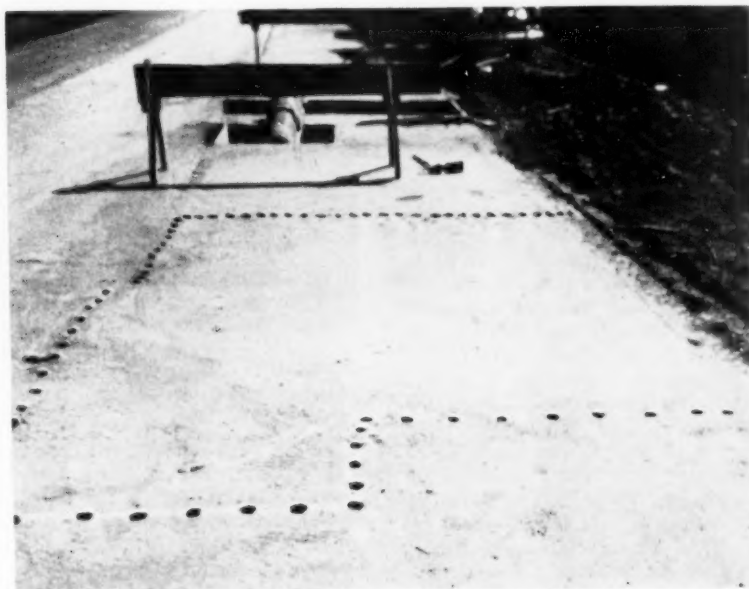
made better with a pneumatic pavement cutter. The top and foundation material should be piled to one side and saved so that it can be used as a part of the trench filling material. The pavement should be cut back about six inches from the edge of the trench on each side, and the pavement should be cut to a straight and vertical face.

Cuts in rigid pavements may be made by sawing, or by boring a row of holes on four to six-inch centers, outlining the section to be removed, and breaking the concrete with pavement breakers. The holes should be located so as to remove the cement concrete for about six inches back from the edge of the trench on each side. The broken concrete can then be removed in any convenient manner and the trench excavated to the desired depth. The discarded concrete may

be used as a part of the upper portion of the back-fill material.

Another method is to use the concrete saw to cut a line around the area to be removed. Here again the concrete should be removed for about six inches beyond the edge of the trench. The saw cut is made through the top one quarter of the depth of the pavement and the remainder broken with the pavement breaker. This leaves a rough face in the lower portion of the cut which provides a strong bond with the new concrete of the patch. At the same time a straight, vertical face

With clay soil this method will not work and the best way is to place this back-fill material in layers about six inches thick and consolidate each layer with hand, pneumatic or explosive rammers. For best results the filling material should be damp but not wet. Broken concrete or stone may be included if the particles are entirely surrounded by fine material such as earth or sand. The discarded foundation and paving material may be used at the top of the refilled trench. Consolidation is a most important factor and every effort must be



Courtesy Portland Cement Association

CONCRETE DRILLS bore holes outlining the area of cement concrete to be removed. Pavement breakers reduce it to pieces small enough to be handled.

is formed at the surface which permits a smooth joint between the existing pavement and the patch. The broken concrete is now removed and the trench excavated.

The next job is to refill the trench so that it will form an adequate support for the replacement section. This is an important procedure and must be well done for either a flexible or a rigid pavement.

The best back-fill material is a stable mixture of sand and clay. However an ideal material is rarely available and the best possible job must be done with what is at hand. Where the subgrade is sand or gravel and the filling material is granular also, the back-fill may be jetted in place and consolidated by the use of water. The water is added as the trench is being filled and as the water drains out the puddled material is left in the trench.

made to get the material in the trench thoroughly compacted so that it is solid.

Material for Filling Holes

Gravel, stone and slag are used for patching untreated roads. The patching material should be similar to that in the existing road so that the patch will become a part of the highway. Stone or slag should not be used to patch a gravel road and for the same reason gravel should not be used on a stone or slag road.

One exception to this rule is the use of temporary patches in winter. These are intended only to carry the traffic until a more permanent patch can be made when the weather is more favorable. Patching

material of this kind is made by mixing gravel or stone, with a top size of about an inch, containing from 10% to 20% of fines, with 50 to 75 pounds of chloride per cubic yard of material. The mixture should contain from 8% to 10% of moisture to insure proper consolidation. The mixing can be done in a concrete mixer or by any other convenient means.

Liquid Bituminous Material

Paint Patches.—Paint or skin patching is surface treatment on a small scale and over a limited area. Therefore practically all of the kinds and grades of bituminous material are used. The choice depends upon the availability of the material and the personal preference of the user. Road tar RT-6, asphalt cut-back RC-2, and asphalt emulsion RS-1 are examples of bituminous materials commonly used for this purpose. In general it is a good plan to use the same or similar bituminous material as was used in the original construction.

Small sized aggregate will be used for the covering material and this will be described later.

Penetration Patches.—The binder for penetration patches may be an asphalt cement of 85 to 100 penetration, an RT-12 grade of road tar or a quick breaking asphalt emulsion RS-1. The first two must be heated for application while the asphalt emulsion can be used cold. Some difference in aggregate gradation and application procedure is necessary when using the hot and cold application material. Large voids in the aggregate are required for the penetration of the hot bituminous materials while small voids are necessary for the cold material to keep it from penetrating too far. Further details will be discussed under "Making the Penetration Patch".

Bituminous Concrete.—Probably more patching is done with bituminous concrete than with any other material. Two general types are used—the cold mix and the hot mix.

Cold mix came into the picture first. When pavements began to extend into the rural areas there was a demand for a patching material which could be mixed on the job without using heat or could be mixed and stored and used from the storage pile. Several types of asphalt and tar binders were developed for this purpose. They consisted of a heavy base and a light carrier which would evaporate or

drain off after mixing. The tars were usually cut-backs and the asphalt emulsions. The asphalt cut-backs came somewhat later.

Aggregates used will vary with the locality. In general the aggregate should be clean and well graded. Material passing the No. 200 sieve should be limited to not more than five percent, since too much fine material produces a stiff mix which is difficult to handle. Such a mix may also lack stability and push out of shape under traffic. On the other hand the voids in the aggregate should be filled with fine material. If this is not done water may penetrate the patch and cause it to fail.

The top size of the aggregate will depend upon the depth of the hole to be patched. Thin patches, up to one half inch in depth can be made best with sand or similar small sized aggregate. One inch seems to be the usual maximum size for patching mix aggregate with $\frac{3}{4}$ -inch rather more common. A typical aggregate gradation for a cold mix is shown in Table 1.

TABLE 1
COLD MIX GRADATION

Sieve Size	Total % Passing
1-inch	100
3/4-inch	90-100
3/8-inch	30-65
No. 4	5-25
No. 8	0-5

This mix must be rather open to permit the solvent to evaporate and the mix thus develop stability. The total bitumen content will run from 5 to 7 percent. As the binder for cold mixes, a cut-back asphalt MC-3 or a mixing emulsion SS-1 may be used. Another way of accomplishing the same result is first to coat the aggregate with about 1½ percent of a liquifier similar to kerosene—MC-0 is often used—and follow with a coating of 85 to 100 penetration asphalt cement. About one percent of hydrated lime is often added to this mix to assist in coating the aggregate. Some aggregates may require an additive mixed with the binder to improve the adherence of the asphalt to the aggregate. Cold mixes are made with the aggregate temperature from 100 to 150 degrees F. All percentages above are in terms of weight of entire mix.

On the early jobs the mixing was done by hand. The aggregate was

placed in a pile, the bituminous material poured on top and the aggregate turned over with shovels until it was coated with bitumen. The tendency always was to use too much bitumen so as to get a coating on the aggregate with as little work as possible. Next came ordinary small concrete mixers which were a great improvement. More recently small bituminous mixers have been developed especially for the production of bituminous concrete for patching. Most of these machines will make both cold and hot mix, and do the mixing excellently and quickly.

Cold mix patching material works better if it is allowed to cure in a pile for several days before using. This is an advantage in that the mix can be made and stored at a central point and hauled out to the work when needed. Often, however, an emergency occurs and the patching mix must be used immediately without curing. If traffic is not too heavy probably no harm will be done, but numerous heavy loads may push the new patch out of shape. Then it must be removed and the job done over again.

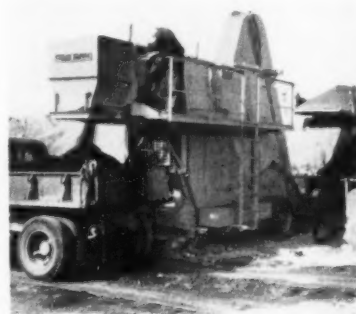
Hot mixes are made with the aggregate temperature about 300 degrees F. The binder generally used is an asphalt cement of 85 to 100 penetration heated to about 300 degrees F. These mixes must be made in a central mixing plant or in one of the new mixing machines designed for making patching material.

Typical aggregate gradations are as shown in Table 2.

The bitumen content will usually run from 5 to 7 percent by weight of the mix.

There is a definite tendency to use more of the hot mixes and less of the cold mixes for patching. The hot mixes have several advantages. Generally the mix is better controlled than cold mixes made on the job, and as a result are more

uniform. Fat patches caused by excess bitumen, cease to be a problem. The mix sets quicker and can be smoothed out better under the roller. Traffic will disturb the hot mix less than other types. The work can be done quicker and thus with less obstruction to traffic and less danger to the men doing the work. It can be used in cold or damp weather and still give good results. The hot mix, however, cannot be stored and used later, but in general must be used soon after it is produced. If the patching operations



Courtesy Iowa Mfg. Co.

CENTRAL PLANT produces bituminous patching mixes for hauling to job.

are scattered and the work done at a slow pace, cold mix will probably be more satisfactory since it will remain workable for a longer period.

Often the patching mix, either cold or hot, can be obtained from a commercial mixing plant. This plant may be at a permanent location or may be a contractor's plant that has been moved into the area. Generally an excellent patching mix can be obtained in this manner. The plant operator can usually produce about any mix desired by the customer, such as the patching mixtures already described. It may be necessary to take the special patching mix at times when he is not producing his regular material. Hot mix can be hauled by truck direct to the patching job and will remain workable for several hours. Cold mixes can be used on the job, if necessary, or may be piled for storage and used from there.

Some highway organizations mix their patching material by means of a blade grader. Generally the aggregate, which is small sized gravel or sand, is spread in a windrow on an abandoned section of highway or other similar convenient location. Bituminous material, which may be one of the light grades of tar or asphalt—RC-2,

TABLE 2
HOT MIX GRADATIONS

Sieve Size	Total % Passing	
	A	B
1-inch	100	...
3/4-in.	95-100	100
3/8-in.	60-80	60-80
No. 4	40-60	35-55
No. 10	20-40	18-32
No. 20	2-5	0-5

MC-2, RT-5 for example—is sprayed on the surface in sufficient amount to have from fifteen to twenty gallons per cubic yard in the mix. The material is moved back and forth with the blade grader until entirely coated. Road mixers can also be used. The patching mix is then bladed into a windrow. It will keep in pliable condition for several weeks and can be hauled where it is needed.

A modification of this method uses a power shovel to do the mixing. The aggregate is arranged in a cone shaped pile and the bituminous material sprayed on the pile during the mixing operations. The same proportions, namely fifteen to twenty gallons per cubic yard, are used as in the blade mixing method. The shovel is used to turn the material over and coat the aggregate with the bitumen. The mixed material is placed in a large pile and used from there.

At one time roads in the snow belt were more or less closed during the winter months and there was little demand for winter patching. Now practically all roads, even local ones, are plowed and kept open. Holes show up quickly and must be patched soon or the road surface will be badly injured. This has created a demand for a winter mix which can be stored and used throughout the winter. This winter mix is usually made at a central mixing plant and stored at some convenient spot. One of the medium curing asphalts or a medium grade of tar—MC-3 or RT-5—is generally used as the binder with regular patching aggregate. From 5 to 7% of binder by weight of mix will be required. Since the patching material may be placed when the hole is wet, about one percent of an anti-stripping agent such as Kotal, No-Strip, or Daracote is added to the binder. This increases the bond between the binder and the aggregate and reduces the tendency of the asphalt to strip from some aggregates in the presence of water. The stock piles are usually covered with tar paper or similar material to keep the water out of the pile. An extra spray or seal coat of bituminous material has been applied to the pile for the same purpose.

Soil Cement

A mixture of soil and portland cement is used successfully as a base for patches.

The soil material used may be any soil that will react with cement to produce a hard, durable mass.

TABLE 3—CEMENT CONCRETE AGGREGATE GRADATIONS

Sieve Size	Total Percent Passing	
	Coarse Aggregate	Fine Aggregate
	A	B
2 1/2-in.	100	...
2-in.	90 - 100	...
1 1/2-in.	35 - 70	100
1-in.	0 - 15	90 - 100
1/2-in.	0 - 5	25 - 60
3/8-in. ....	...	100
No. 4 ....	...	0 - 10
No. 16 ....	...	45 - 80
No. 50 ....	...	5 - 25
No. 100 ....	...	0 - 10
No. 200 ....	...	0 - 3

Size B is used for small patches, up to a foot in width or diameter; size A for larger patches.

The soils vary from sand to clay. Friable, easily pulverized soils will be the most satisfactory and easiest to handle. The soil should be screened through a regular plasterer's screen to remove large lumps. Sands containing some fine material, stone screenings, sand clays, and decomposed rock, are the best soil materials for this work.

Approximately ten percent of cement by volume of soil cement mix will be required. On large projects standard laboratory tests should be made to determine the proper amount of cement needed. These tests can be made by commercial testing laboratories. In some states

to produce a damp, but not wet, mix and the mixing operation continued until a uniform material is produced. This mixture cannot be stored and must not be permitted to become dry. In general the soil cement should be placed and compacted within two hours after mixing.

Cement Concrete

Portland cement concrete for patching is made by mixing the proper proportions of coarse and fine aggregate, cement and water in a concrete mixer. The coarse aggregate may be gravel, broken stone or slag and the fine aggregate may



Courtesy McConaughay

HOT BITUMINOUS CONCRETE patching mixtures can be used in cold weather and even if there is snow on the ground, provided the holes are made dry.

the state highway testing laboratory will do the work for other public organizations.

The mixing will usually be done at the source of the soil material. The soil is measured by loose volume and mixed dry with the proper amount of cement in a cement mixer. Sufficient water is then added

be natural sand or stone sand. The aggregates used should meet the standards of the department doing the work. The cement used may be normal portland cement or high-early-strength cement. The latter is used to produce a concrete which increases in strength rapidly so that the patch may be opened to traffic

TABLE 4—CONCRETE PATCHING MIX

Maximum Slump 1½ inches Normal Temperature

Type Cement	Patch opened in	Cement per cu. yd.	Water per sack	Calcium Chloride per sack	Sand and Coarse Aggregate per Sack of Cement				
					Gravel Concrete		Stone or Slag Concrete		
					Sand	Gravel	Sand	Stone	Slag
	Hours	Sacks	Gallons	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
High-Early Strength	24	8.0	4.0	0	120	250	140	230	195
High-Early Strength	24	6.5	5.0	2	160	325	185	300	255
Normal	72	8.0	4.2	0	130	265	150	245	210
Normal	72	7.0	4.7	2	150	300	170	280	240
High-Early Strength	72	5.5	6.0	0	200	400	230	370	315
High-Early Strength	72	5.0	6.5	2	225	455	260	420	355

sooner than when normal cement is used.

Flake or granulated calcium chloride may be used to accelerate the set of the concrete in cold weather.

Typical gradations for aggregate are as shown in Table 3.

The proportions of aggregate, cement and water should be selected to give the desired strength and durability. Table 4 gives recommended values for various cements, aggregates and admixtures.

Calcium chloride is used to accelerate the set and increase the early strength of the concrete and is especially useful in cold weather. Generally about two pounds of calcium chloride per sack of cement will be used. Dry calcium chloride is added to the aggregate in the skip of the concrete mixer. It should not be placed in direct contact with the cement. A quart of dry calcium chloride will weigh two pounds.

The calcium chloride may also be made into a solution and added to the mixing water. Five pounds of dry calcium chloride added to one gallon of water will produce five quarts of solution containing one pound of calcium chloride per quart. The calcium chloride should be added to the water and not the water to the calcium chloride in making the solution. Do not forget to allow for the water in the solution when measuring mixing water in which the solution is to be used.

Additional calcium chloride may be used for very low temperatures as follows: 32 to 25 degrees F—3 pounds per sack of cement; 25 to 20 degrees F—4 pounds per sack of cement.

Not more than four pounds of calcium chloride per sack of ce-

ment should be used under any circumstances.

It is important that the mix be kept fairly dry to reduce shrinkage, so the maximum slump should be 1½ inches. Mixing may be done in a concrete mixer on the job with the usual one minute mixing time.

Much cement concrete patching material is now being purchased from central mixing plants and de-

livered to the job in concrete hauling trucks. This is a very convenient arrangement and often is cheaper than doing the mixing at the job site. If the organization doing the work—city, county or town—has specifications for portland cement concrete for pavements the central mixed concrete should conform to them. Otherwise proper proportions can be selected from Table 4.

Procedure For Making The Patch

Untreated Roads

Gravel.—The patching gravel, similar to that in the existing road, can be placed in the holes and weak spots in any convenient manner. Usually it is spread or dumped from a truck and then spread with a blade grader or rakes. It is then left to consolidate under traffic. Some additional blading or smoothing will probably be necessary during the consolidation period, which may last for several days. This particular patching operation can be done better when the road is wet than when it is dry.

Broken Stone or Slag.—Roads of this sort should be patched with stone or slag similar to that used in the original construction.

Shallow holes, up to three inches in depth, may be patched with screenings or small sized crusher run material. The top size of the crusher run material should not be over one inch. For best results the filling material should be damp when applied. Generally preliminary consolidation by a roller or by truck wheels will be advisable, with final consolidation by traffic. Care must

be taken to keep the patched area level with adjacent surfaces.

Holes more than three inches in depth must be dug out and prepared as described previously. They are then filled with stone or slag ranging up to 2½ inches in size. Typical gradation of this coarse aggregate is shown in Table 5. This layer of aggregate is tamped or rolled in place. If the hole is very deep the patch should be constructed in layers approximately four inches thick. The voids are then

TABLE 5
PATCHING AGGREGATE

Sieve Size	Total % Passing
2½-in.	100
2-in.	95-100
1½-in.	35- 70
1-in.	0- 15
½-in.	0- 5

filled with screenings or sand. The filling material is introduced gradually so as to fill the voids thoroughly. Water may be used to assist in the filling and the consolidation. The patch should be rolled and finished



Courtesy Calcium Chloride Institute
CHLORIDE mixed with gravel makes patching material for temporary use.

level with the existing pavement surface. The entire operation is similar to the construction of a water bound macadam road.

This same procedure is used in building a new base or foundation on the bottom of deep holes in other pavement types.

Paint Patches.—Paint patches are used to cure abraded or cracked areas in bituminous pavements. The

is clean and dry the bituminous material is applied in the proper amount. It should be covered immediately with one of the covering aggregates listed in Table 6. A broom or broom drag may be used to assist in spreading the aggregate uniformly over the road surface. The covering aggregate should be set in the bitumen by rolling with a rubber tire roller or a steel flat wheel roller. This rolling should be done as soon as the bituminous material has set sufficiently to hold the cover. The actual time will vary with the grade and type of bituminous material, and the temperature and other weather conditions. Generally it is not necessary to wait more than a half hour before starting the rolling and often it can be done immediately after the covering material has been spread. Two or three passes of the roller will usually be sufficient.

bituminous pavement types and are sometimes used on cement concrete.

If the depth of the hole to be patched is more than three inches the cost of the repair will be reduced if the bottom of the hole is filled with macadam or other base material. This base must be thoroughly consolidated before the penetration patch is constructed.

After the hole has been properly cleaned and shaped the penetration aggregate is placed in it. The aggregate may be broken stone or slag and should have a top size of two to three inches depending upon the depth of the hole. The aggregate should be nearly a one-sized material, rather than graded from fine to coarse, if a hot binder is to be used. Since the strength of the patch depends upon the interlocking of the aggregate particles, a crushed or at least an angular material should be used.

The dry aggregate in the hole should be thoroughly consolidated by tamping or rolling. Bituminous binder, road tar RT-12 or 85 to 100 penetration asphalt cement, is poured into the voids of the consolidated aggregate at the rate of one gallon per square yard for the top inch and one half gallon per square yard for each of the additional inches of depth. The asphalt or tar is heated for application. The temperatures will be approximately 250 degrees F for tar and 350 degrees F for asphalt. The binder may be heated in a kettle and poured from pouring pots by hand. A small bituminous distributor with a hose and nozzle will be better. The binder is usually heated in a separate heater and the truck heating facilities used to keep it at the proper temperature.

TABLE 6—AMOUNTS OF MATERIAL PER SQ. YD. FOR PAINT PATCHING

Aggregate Top Size	Stone or			Bitumen Gallons
	Sand Pounds	Gravel Pounds	Slag Pounds	
3 4-in.	28	23	0.40
1 2-in.	20	16	0.30
3 8-in.	17	13	0.25
1 4-in.	13	11	0.20
Sand	10	...	...	0.15

method is also used sometimes to correct surface conditions, scaling, etc., on cement concrete pavements.

Paint patching is surface treatment on a small scale. Small bituminous distributors with spray bars which can be divided into short sections, so as to spray narrow widths, are commonly used.

Since we are treating cracked or abraded sections which will absorb some of the bitumen, more material will be needed than when treating a normal section. There should be sufficient binder on the surface to surround the covering aggregate to about one half its depth. The covering aggregate should be one particle deep over the area being patched. For various top size aggregates the amount of material required will be given in Table 6, which is based on stone and gravel at 2400 pounds and slag at 1900 pounds per cubic yard, loose measurement.

The first step is to clean the surface to be treated by sweeping. A blast of air may be used to assist in this operation. When the surface

If the patch can be closed to traffic for several hours after rolling, the cover will be held much better.

Treated and Paved Surfaces

Penetration Patches.—Penetration patches may be used on any of the



Courtesy Littlefield

PRESSURE DISTRIBUTOR spraying bituminous material into a penetration patch.



Courtesy Portland Cement Assn.

TAMPING soil-cement base to provide foundation for a pavement patch.

If an asphalt emulsion binder, RS-1, is used the aggregate should be graded from fine to coarse so as partially to fill the voids. This is necessary to prevent the asphalt emulsion from going to the bottom of the hole. Under normal conditions the asphalt emulsion need not be heated.

After the first coat of bituminous material has been poured the surface voids should be filled with clean stone, slag chips, or pea gravel, and rolled. Only sufficient aggregate should be used to fill the surface voids, and no more. The filler should be moved about with brooms or a sweeper during the rolling, to assist in obtaining a uniform distribution of the filler and to assure the complete filling of the surface voids. Excess filling material should be swept off before the seal coat is applied. A seal coat of the same grade and kind of bituminous material used in the penetration course, is applied at the rate of one quarter to one half gallon per square yard. This is covered immediately with the same kind and size of aggregate used to fill the surface voids. A final rolling and sweeping operation completes the job. Three or four passes of the roller will be needed.

In this type of patching, the tendency of the workers is to use too much bituminous material. The amount must be kept within the limits given. Care must also be taken to see that the surface of the patch is at the same elevation as the surrounding pavement. A straight edge or line should be used to assist in obtaining this result.

This entire operation is similar to the construction of a new bituminous penetration macadam pavement.

Bituminous Concrete Patches.—Bituminous concrete is used to patch all kinds of bituminous pavements and is also used for patching rigid pavements.

The hole or defective area should be prepared as described in the section on that subject. If the patch to be made is more than three inches thick, money can be saved by using stone or similar material to fill the bottom of the hole and build a base to support the patch.

The sides of the hole should be painted with a thin coat of one of the lighter bituminous materials such as asphalt SC-1, or RC-1, asphalt emulsion RS-1, or road tar RT-2. The material should be applied with a brush. This paint coat will assist in bonding the patch to the old pavement and will help to water-proof the edges of the patch.

The bituminous concrete is now placed in the hole and spread by rakes or shovels so as to fill the

layer of screenings, sand or similar granular material. This layer should be about three inches thick and the material composing it is thoroughly consolidated in place by means of mechanical tampers. To insure proper consolidation the insulating material should be damp but not wet.

Upon this prepared insulating material the soil-cement is placed in layers about three inches thick. It is spread by means of rakes or shovels, and then thoroughly tamped in place. The top of each layer is scored by a rake or similar tool, so that the next layer will bond with that already placed. The soil-cement base is constructed in layers to a point where there is just sufficient vertical distance remaining



Courtesy Austin-Western

ROLLING BITUMINOUS concrete patch with steel tire roller. By thorough consolidation the new patch is constructed level with the surrounding pavement.

hole. The material is then tamped or rolled into place. A straight edge or string can be used as a guide in finishing the patch so that it will not be lower or higher than the surrounding pavement.

Bituminous concrete is one of the easiest patching materials to use and with only ordinary care excellent patches can be produced.

Soil-Cement Patching.—Soil-cement may be used for the construction of new bases under patches in either flexible or rigid pavements. Failed and defective foundation material should be excavated until a firm subgrade is reached. The bottom of the hole is then covered with an insulating

for the placing of the bituminous top. The soil-cement should be allowed to cure for 48 hours under paper, wet bags or wet earth. The bituminous surface may then be placed.

If the application of the bituminous surface is to be delayed the soil-cement can be prepared to carry traffic for a short time. This is done by applying from an eighth to a quarter gallon of a light bitumen per square yard to the surface. The bitumen used may be an asphalt RC-1, MC-1 or road tar RT-2. The bitumen is covered with sand and the patch may be opened to traffic. However this is only a temporary expedient and the period prior to

the construction of the bituminous surface should not be more than four weeks. The soil-cement makes an excellent supporting foundation but should not be expected to withstand the abrasion of traffic without the protection of a bituminous surface of some sort.

Patching Rigid Pavements

Holes and Defects.—Rigid pavements may be a cement concrete or a cement concrete foundation with a bituminous top.

The hole or defective area in the cement concrete should be prepared as described in the section on that subject. In general the patch should be at least as thick as the concrete slab, and may be thicker. It is good practice to place a three inch layer of damp sand, stone screenings, or similar granular material as an insulating layer in the bottom of the hole. Of course additional excavation must be made to provide for this. The insulating material should be well consolidated by tamping for small areas or by rolling if the area is large enough. The bottom and edges of the hole should be dampened with water before the concrete patching material is placed. This will increase the bond between the new patch and the old concrete. It will also reduce the absorption of water from the patched area.

The patching concrete may be prepared on the job or obtained from a central mixing plant. As stiff a mix as can be placed should be used to keep shrinkage of the patch to a minimum. A slump of 1½ inches is usually specified. A concrete of this consistency will flow from a square edged shovel with difficulty. The concrete is placed in layers from three to four inches in thickness. Some hand tamping of the stiff mix will be required to obtain a smooth, dense, concrete patch but the shrinkage will be low.

The surface of the concrete patch should be screeded by a screed riding on thin shims on the surrounding pavement. Thus the new concrete will be slightly above the old surface and, after the concrete has stiffened, the patch can be finished by floating to match the surface texture, as well as the elevation, of the old pavement.

If an expansion or contraction joint intersects the patch a joint of the same sort should be constructed through the new concrete. Otherwise the small area of the patch will be subjected to great compressive stress and may fail as

the temperature of the pavement rises.

If calcium chloride has been used in the preparation of the patching cement concrete, no curing other than covering with burlap or straw will be needed. If calcium chloride has not been used the regular curing procedure with membrane, paper or similar material should be carried out.

The cement concrete patch must be kept closed to traffic until it has developed sufficient strength to support the traffic coming upon it without injury to the concrete. This period will vary from one to several days, depending upon the type of cement concrete patching mixture used, and the temperature of the pavement.

Bituminous concrete patches may be placed in cement concrete pavements. Usually these patches are not more than three inches thick. The portion of the hole below the

bituminous concrete can be filled with soil-cement, aggregate, or similar material, thoroughly tamped or rolled in place. The bituminous concrete to make the patch is then placed as described in that section.

Spalled Areas.—Small spalled areas in cement concrete pavements have been patched successfully with cement mortar, using a 1:2 mix with a very low water content and an admixture of calcium chloride.

The area to be patched is trimmed and then cleaned with a 25 percent solution of muriatic or similar acid. The acid is washed out with water and the excess moisture removed before patching.

The mortar mixture consists of one part of portland cement and two parts of concrete sand with an admixture of two pounds of calcium chloride to a sack of cement. Just sufficient water is used to produce a thick paste.

After cleaning, the patch is coated



PAVEMENT SECTION sawed and removed. Note the rough texture of the lower part and the straight even line in the upper part of the edge of the concrete.

Courtesy Tri-Line Company



Courtesy Portland Cement Association

CEMENT CONCRETE hauled from a central mixing plant being placed in hole to form a patch. Tube vibrator used to assist in consolidating the concrete.

with mortar, using a stiff brush. The entire depression is then filled with mortar and the surface finished by brooming or belting to match the surface finish of the surrounding pavement.

A little coloring matter, either yellow ochre or carbon emulsion, may be added to the mortar to produce a color which is the same as that of the surrounding pavement. Cement mortar gunned in place is an alternate patching method.

The patch should be protected by burlap, or similar material for twenty-four hours after which it may be opened to traffic.

Reducing Patching

Now that we know how to make successful patches, let us see what we can do more nearly to eliminate the necessity for making them.

If a road is properly maintained the need for much annual patching can be greatly reduced. Continuous and effective maintenance throughout the year is the answer. Neglect of surface treatments on bituminous surfaces will permit the pavement to become dry and brittle. Traffic soon abrades the surface, water enters and may freeze, and a hole is produced. Just how often a pavement should be surface treated depends upon a number of factors such as the age of the pavement, climatic and weather conditions, traffic, etc. The time between treatments may run from three to ten or more years. However, when the surface looks dry and the aggregate can be removed easily, the road



Courtesy Portland Cement Association

CEMENT CONCRETE PATCH has been placed and is being struck off level with the surrounding pavement. It will be finished to match the original texture.

should be given a surface treatment. Failure to correct a bad base condition before patching means that another hole will appear in the same location soon. All of us have seen the patching crew working at the same place year after year.

Bad drainage is indicated by free water in and around the pavement. Outlets must be provided to permit the water to drain away rapidly. The best time to spot these conditions is in wet weather. To correct the condition it may be necessary to deepen the ditches and perhaps install drain pipe or other drainage structures.

Cement concrete pavements which have scaled and raveled on the surface should be protected immediately as we have described. Otherwise

the abraded area may become deeper and extensive patching and replacement required.

Pumping action of cement concrete roads will continue to break the concrete until the conditions causing the pumping are corrected. The pumping is caused by lack of support of the concrete slab. That means that the bad conditions underneath the slab must be corrected. This is done by boring holes in the slab and pumping new supporting material — bitumen, soil-cement, prepared earth, etc.—under pressure through the holes. The new material fills the voids, displacing unstable material, and the slab is properly supported again. Truck traffic, with units above the legal weight limit, may cause additional breaks in the concrete. Thus enforcement of the legal weight limit becomes a factor which influences the amount of patching necessary.

A new bituminous concrete top over the old concrete will often add sufficient strength and reduce the impact so that the road can carry the load efficiently.

Efficient and timely filling of cracks and joints in cement concrete pavements will reduce the patching problem. If joint openings are permitted to become filled with roadside dirt, sand and pebbles, they can no longer care for the expansion and spalling of the concrete may result. Open joints and cracks will permit water to pass through the slab and weaken its support.

Probably patching will always be with us but the amount can be greatly reduced by efficient, day to day, maintenance of our roadways.

Additional Data on Materials and Equipment for Patching Pavements

For specific information on equipment and materials mentioned in the foregoing article, readers are referred to advertisements appearing in this issue and to items in the Readers' Service section, page 38. Latest information, catalogs and specifications may be obtained by writing direct to the manufacturers or by using the convenient reply card bound inside the front cover of this issue. When writing direct, please mention PUBLIC WORKS.

Air Compressors

Page 19

Bituminous Concrete Mixers

Pages 41, 92, 98, 100, 101, 115; Readers' Service Nos. 171, 205, 297, 304

Bituminous Distributors

Pages 95, 106, 112; Readers' Service Nos. 41, 79, 137

Cement Concrete Mixers and Placement

Page 111; Readers' Service No. 215

Concrete Saws and Drills

Pages 40, 96, 97, 111, 116; Readers' Service Nos. 22, 85, 146, 202, 295

Cover Spreaders

Page 14; Readers' Service No. 231

Heaters and Dryers

Pages 100, 101, 110, 125; Readers' Service No. 254

Heating Kettles

Pages 108, 110, 125; Readers' Service Nos. 206, 277

Loaders

Pages 21, 25, 51, 105; Readers' Service Nos. 39, 55, 234

Mixing Machines

Page 103; Readers' Service No. 233

Patching Materials

Pages 58, 99, 102; Readers' Service Nos. 53, 134, 199, 283

Rollers

Readers' Service No. 142

Sweepers

Readers' Service No. 77

Tampers

Readers' Service No. 108

Lighting and Traffic Control

1952 Traffic Toll . . . 38,000

The 1952 traffic toll was 38,000 dead, 1,350,000 injured, with more than 3.6 billion dollars estimated cost. Death toll from traffic accidents alone was almost twice as great as the battle death toll of Americans in the entire Korean war. Motor vehicle accidents were the nation's No. 1 killer, with home accidents second.

Motor-vehicle deaths in 1952 were higher for the third consecutive year. The increase over the previous year, however, was the smallest during this 3-yr. period. Highlights of the 1952 record are as follows:

	1952	% Change from 1951
Deaths	38,000	+2%
Injuries	1,350,000	+2%
Cost	\$3,600,000,000	+5%
Mileage	518,000,000,000	+5%
Death Rate	7.3	-4%

From an article by Gene Miller in Public Safety as reported by Highway Abstracts.

Traffic Signals are Valuable, but No Cure-All

Next to speed limits, the traffic signal is Mr. Average Citizen's favorite remedy for his traffic ailments, according to the 1952 report of the Board of County Road Commissioners of Wayne County, Mich. This may account, to a considerable extent, for the fact that demand for signals during the past 7 years has been so great that the Board's engineers never have been able to keep up with investigations for them. A large percentage of signal requests are denied for lack of sound engineering need. On the other hand, rapidly changing traffic conditions created by expanding industries and residential communities have created an unquestioned need for these devices at many locations. There seems to be no other structure, short of an expensive grade separation, that can perform the same service.

As labor and material costs have gone up, the cost of signal lights has risen. While more vehicles on the roads would seem naturally to demand more signals, yet delays caused to these vehicles by un-

necessary signals can cost the highway user great sums in expensive delay and accidents. It is for these reasons that the Board's engineers make careful and often extensive surveys to determine the necessity for traffic signals, and those found unwarranted are denied.

In some instances, old signals that were installed on narrow roads to serve small numbers of vehicles are in need of rebuilding to accommodate wider roadways and greater traffic volumes. Such locations are being modernized as rapidly as the need arises.

The Board works closely with the State Highway Department and municipalities in Wayne County on the installation and operation of traffic signals. It installs and operates signals for the State on trunkline highways and trade installations on County roads with municipalities that have adjacent systems of their own.

Better Crosswalk Engineering

In an effort to reduce the number of accidents involving school children, Fort Wayne is revamping its school crosswalk program. A new type of crosswalk is being used and in some cases consolidations of crosswalks have been made. A resident map showing the location of all pupils in the community is prepared in order to pin-point the exact location and need of a crosswalk. It was found that in some areas, children were using as many as six different crosswalks in the vicinity of the school. The new walks are bounded by an eight-inch line and have solid painted lines eighteen inches wide at sixteen inch intervals. Officials said that the new walk is much more visible to the motorist.

The above data were reported in the Toledo City Journal, which also said that a plan to get pedestrians across intersections faster will be tested in Milwaukee. Walkers will be able to cross in all directions including diagonally. The plan has been used successfully in Denver and Kansas City. The experiment will last from four to six months with pedestrians getting 25 seconds of the 90 seconds cycle to cross the intersection.



NEW *McConnaughay* MODEL HTD-LP MULTI-PUG ASPHALT MIXER (6 Cu. Ft. Capacity)

In any season . . . under wet or dry conditions . . . this new McConnaughay HTD-LP Mixer can assure you the fastest, most economical production of bituminous paving mixtures (hot or cold) for big patching jobs, small resurfacing projects, driveways and parking areas. Working right on location, it provides the exact amount of paving material needed . . . never too much or too little. With mixer and heating unit combined, it will reactivate and heat up to 20 tons

of stock pile mixture per hour, prepare up to 8 tons of hot or 18 tons of cold asphaltic mixtures per hour, dry various types of wet aggregates quickly, remove both moisture and solvents from bituminous mixtures. Other features include low pressure burner, blower for fuel atomization, stacks for removal of gases, 6 cubic foot mixer capacity. Write, wire or 'phone for details and specifications.

K. E. MCCONNAUGHAY
LAFAYETTE 2, INDIANA

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Building Earth Fill Approaches to a New Bridge

FRANK B. CAULEY,

Highway Commissioner, Mauston, Wisc.

THE job of building two earth fill approaches to a new I-beam concrete deck bridge included removing the old bridge, the abutments and the center pier and constructing the earth fill approaches for the new bridge. The old bridge over the Lemon Weir River was a pony truss type. This was removed with a crane. The stone abutments and the stone center pier were salvaged and the stone used for riprap around the abutments of the new bridge.

The earth fill approaches to the old bridge were removed with a rented dragline and sidecast into the approaches for the new bridge. A Caterpillar tractor with bulldozer spread and leveled this fill. Additional space and fill was needed for the south end of the job, so land was purchased. Two Caterpillar tractors with LeTourneau scrapers hauled dirt 800 ft. from a borrow pit. Caterpillar tractor-bulldozer units were used for leveling the fill, for clearing work in the borrow pit and for final shaping and finishing of the new grade.

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Maintenance and Snow Removal Problems in a Big County

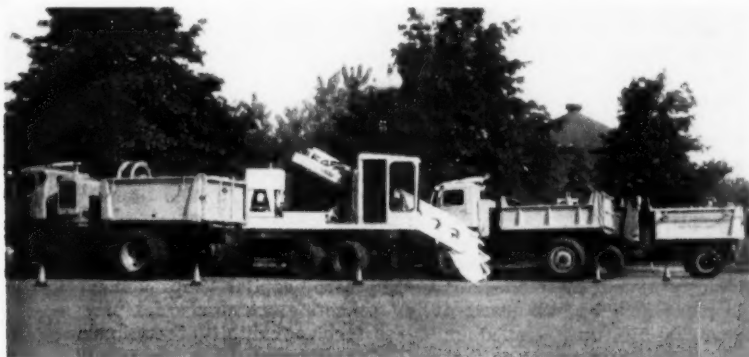
MARION ST. JEAN,

Road Superintendent, Tooele, Utah

THERE are about 1,000 miles of roads in Tooele Co., and with limited funds we must plan our work carefully and use equipment to the best advantage. Our snowfall is heavy most years. We use four trucks with blade plows and three patrols, one with a V plow, another with side wings and the third as a pusher behind the V plow in deep drifts. Also a D7 Caterpillar is used on the higher passes where snow drifts to depths of 8 to 15 ft.

Our surfacing program includes a small amount of bituminous surfacing, some seal coating and a good deal of gravel surfacing. This is mostly done with pit-run gravel of which we have a plentiful supply. The most useful equipment in this work is our C55 Link-Belt Speeder shovel which is rubber-mounted and has a road speed of 12 miles an hour, but can be towed behind a truck at 25 mph. For a big county like ours, this is one of the most useful units I know of.

VICE PRESIDENTS MILTON OFFNER EDWARD P. DECHER RALPH C. GRAHAM WARREN A. COOLIDGE PAST PRESIDENT EDWARD J. CLEARY	<h1 style="margin: 0;">APWA</h1> <h2 style="margin: 0;">news</h2> <p style="margin: 0;">AMERICAN PUBLIC WORKS ASSOCIATION 1313 EAST 60TH ST., CHICAGO 37, ILL.</p>	DIRECTORS J. J. DEAN SOL ELLENSON GEORGE G. HYLAND JEAN L. VINCENZ TREASURER ALBERT G. WYLER
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● Some of the equipment exhibited at meeting of Upstate New York Chapter.

Iowa Petitions for Local APWA Chapter and Other Chapters Report on Spring Activities

Ralph Graham, Supt. of Construction and Public Works of Davenport (Central Area Vice-President) and Carl C. Fagerlind, Street Commissioner of Waterloo (Iowa State Chairman) have submitted a petition to the Board of Directors for the establishment of a Chapter in that State. The organizational meeting will be held in September at which time the charter for this—the fifteenth chapter of the Association—will be granted. Officers for the new chapter will also be elected at that time.

Schenectady Hosts Upper N. Y.

The City of Schenectady, N. Y., was host at the annual meeting of the Upstate New York Chapter of APWA. During the two-day program, members inspected local public works installations and equipment exhibits, and heard talks on a variety of subjects, including requirements of the Water Pollution Board, sewerage system maintenance, waste collection and incineration, paving with blacktop, snow and

ice control and water treatment laws. William J. Spellacy, Commissioner of Public Works of Binghamton was elected President for the coming year. Convention Chairman was John F. Lucey, City Engineer of Schenectady.

Michigan Holds Garbage Confab

Chapter meetings were also held in other sections of the country last month, including Philadelphia, Detroit and Chicago. The Michigan Chapter meeting at Detroit, consisted of a Seminar on Garbage Disposal. One of the highlights of the Chicago Chapter meeting was its annual exhibit of public works equipment. The Philadelphia Chapter meeting featured an informative talk by Leslie Williams, Deputy Commissioner of Streets, who is in charge of the City's Traffic Engineering program.

Ohio River Valley Chapter

Public Works officials in Ohio, Kentucky and Indiana should plan
(Continued on page 94)

APWA COMPLETES SURVEY OF STREET LIGHTING PRACTICE

Nearly One-third of Cities Clean Their Glassware Annually; 28% semi-annually

Preliminary results of a survey of street lighting practices in 295 municipalities show that group replacements are made in 43% of the municipalities reporting. Glassware is cleaned annually by 30% of the municipalities and semi-annually by 28%. The practices in the other municipalities vary considerably. Fifty-one percent of the systems are of the series circuit type, about 8% are of the multiple circuit type, while 41% report that both the series and multiple type circuits are in use. The time clock method of street lighting control is used by 51% of the municipalities that report the use of only one method of control. The photo-electric method of control is the next most popular.

Municipalities are about evenly divided on the question of whether the operating cost of mercury vapor lighting is higher or lower than the operating cost of incandescent lighting. Virtually all municipalities, however, report that traffic safety is improved by the installation of mercury vapor street lighting.

These and other interesting facts were reported in this survey soon to be published as a Special Report for distribution to the APWA members. This report is being prepared by the Headquarters staff with the advice of the Association's Committee on Public Lighting, headed by Neal B. Thayer, Manager, City Water and Light Plant, Jonesboro, Arkansas.

How By-Passes Affect Life of Community Is Discussed at Recent Purdue Road School

HAROLD L. MICHAEL, Research Assistant, (Joint Highway Research Projects) at Purdue University presented a very interesting paper on the use, effect and control of by-passes at the 39th Annual Purdue Road School held in Lafayette, Indiana, April 6-9. His paper is based on data collected during "before" and "after" studies on two by-passes around Kokomo and Lebanon, Indiana—populations of 38,672 and 7,631 respectively. The effects of these by-passes on the users, the community and the general public are enumerated.

Through Traffic Benefits

By-pass use in these cities is shown to be of a variable nature. In both cities the through traffic benefited greatly and a large percentage of this traffic in both cities used the by-pass. Congestion relief, however, resulted for the old route only in Lebanon. Reasons for this are given and methods of evaluating these reasons in other cities are established. The use of the by-pass as a collector and distributor route is also different for the two cities. The nearness of the by-pass to developed sections of the city is believed to be the most important of several factors affecting this type of traffic movement.

Most Businessmen Favorable

The effect of the by-pass on traffic accidents, land use, land value and business are shown to be largely beneficial. The development of land along the by-pass accelerated "after" the by-pass and land values increased not only because of the actual new development, but due to potential development probabilities. Certain types of business along the old routes reported some decreased earnings which they attributed to the by-passes. The majority of all business-men along the old route, however, did not suffer losses and reported a favorable reaction to the construction of the by-passes. The study indicated that the total business in each of the cities did not suffer but probably increased because of new locations and the better highway facilities. The seriousness of accidents on the by-passes, due to higher speeds of the vehicles involved proves a very difficult problem, however.

How to Get More Complete Data

Each month special news items are included in this column to acquaint our readers with the activities and nature of services rendered by the APWA. Supplemental information concerning items appearing in this column is presented in the Association's Newsletter. Find out about membership today by writing to the Executive Director, 1313 East 60th Street, Chicago 37, Illinois.

A probable increase in the number of accidents and a decrease in the time and vehicle-operating cost savings are predicted for both by-passes unless the interference of traffic generated by road-side developments can be minimized. It is shown that the uncontrolled building of new access routes to the by-passes is rapidly causing the new facilities to become congested and to be operated as city streets.

Control of Access Called Essential

The possibilities of controlling or even limiting access to these and future facilities are discussed and the experiences of other states noted. It is concluded that a by-pass facility should be constructed only after a thorough analysis of all local factors and that the control of access along the route must be a part of the initial plan if the new route is to fulfill the purpose for which it is constructed.

This and their interesting papers of special interest to public works officials will be published in the Proceedings of the Purdue School.

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Chapters Report

(Continued from page 93)

now to attend the Annual Meeting of the Ohio River Valley Chapter of APWA, June 12 at Dayton, Ohio. Myron Tatlock, Consulting Engineer at Dayton and President of this chapter reports that the program will include an equipment exhibit, tours, talks on public works administration and finance, concurrent panel sessions on street, traffic and

PUBLIC WORKS for June, 1953

refuse problems, and a banquet at which they will elect new officers.

Stamps Heads Alabama Chapter

John L. Stamps, Street Cleaning Supervisor of Birmingham, Alabama was recently elected President of the Alabama Chapter to succeed Mayor W. H. Albright of Haleyville. Samuel D. Lasseter, Commissioner of Public Works at Gadsden, was elected Vice Pres.

NY-NJ Metropolitan Group

Over 250 members and guests of the N. Y.—N. J. Metropolitan Chapter attended the annual Spring Meeting of this group on May 27 at Long Beach, N. Y. Highlights of the meeting were inspections of the City's new sewage treatment plant of 9.5 MGD capacity; the new 200-ton refuse incinerator; a new 4.5 MGD capacity water treatment plant; and other municipal improvements, all of which have been constructed in a little over three years. City Manager Maurice J. Fleishman gave a very interesting talk on the problems of financing these capital improvements. The meeting, which also featured an extensive exhibit of equipment, was arranged by Leonard S. Wegman, City Engineer.

Minnesota Meets at Virginia

The Minnesota Chapter will also hold its annual meeting at Virginia, Minnesota June 11-13 in conjunction with the Annual Convention of the Minnesota Municipal League. Announcements and reports of other chapter meetings regularly appear in the Associations monthly News Letter.

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FILM OF THE MONTH

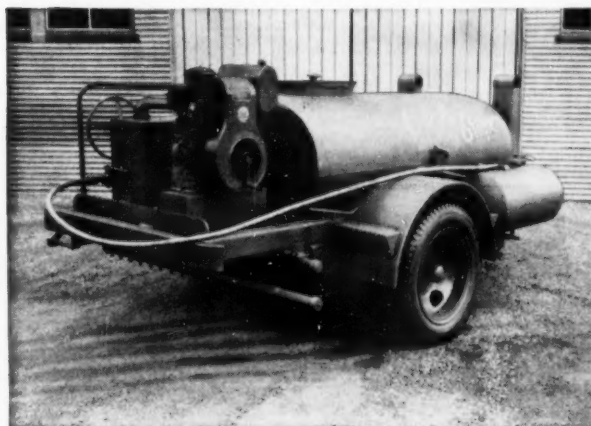
"Savannah, Georgia, Underground Maintenance" is the title of an exceptionally fine film produced by the City of Savannah, Georgia. This sound film—made in full color, has been shown to groups on the campus of Georgia Tech., Clemson College and various civic bodies throughout the Southeast and has been well received in every instance. The film depicts the daily problems and experiences of the City's Sanitation Department in maintaining its sewerage system. Persons and/or organizations interested in borrowing this film should address their requests to Mr. Norris Sherry, Director of Public Works, City Hall, Savannah, Georgia, and send a carbon copy to PUBLIC WORKS Magazine.

It's Etnyre "Black-Toppers" for new roads...for old roads!



Accurate distribution, dependable performance, economical operation are features built into every Etnyre "Black-Topper." Note that straight-line edge, that complete triple-lap coverage in photograph above.

Use your "Black-Topper" to pump bituminous material through Etnyre's new Underseal Gun to stabilize concrete pavement subgrade. Get details and prices —ask about Gun No. US-1A.



Etnyre Maintenance Units are the answer to maintenance and construction work on small jobs. Completely equipped for filling, circulating, spraying, hand-spraying, and transferring. Get prices on Model "MU."



Handspraying can be handled simply and efficiently. Each "Black-Topper" comes equipped with convenient handspray controls, 25' flexible steel asphalt hose, and cold handle handspray gun.

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"Black-Topper"
BITUMINOUS DISTRIBUTORS



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**EASIER!
FASTER!
BETTER!**

**RCD Drill Bit for use with
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Drills perfect, precision holes even in reinforced concrete. Super fast and easy (6" deep hole in 1 minute!) Pays for itself in time-savings. Made to last.

Widely used for the past five years by most of the largest U. S. corporations, manufacturers, and utilities, as well as thousands of smaller firms, installation men, contractors, electricians, plumbers, etc. Superior concrete drilling plus longer drill bit life due to **FREE** factory re-sharpening service keeps them sold.

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**Brush Away
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sticky side
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Washington



news

Presented in cooperation with the American Public Works Association
and through the courtesy of the
Washington Office of the American Municipal Association.

EIGHTEEN of the 43 state legislatures that have met so far this year, have adjourned sine die. The Alabama session convenes May 5. Much legislation has been considered in the highway field. Following are the highlights:

(1) In 35 states memorials have been introduced urging Congress to repeal the Federal tax on motor fuel. Up to the present they have been adopted and sent to Congress in 19.

(2) In addition to the 24 States that require use of motor vehicle taxes for highway purposes by constitutional amendment, two more state legislatures, Maryland and Wyoming, have adopted these provisions, subject to the approval of the voters. The proposal has also passed one House of the Connecticut legislature.

(3) Ten states are still actively considering mileage taxes. Maryland increased its gas tax from 5 to 6 cents. Fifteen states are still actively considering motor fuel tax increases.

(4) Four states increased the length of buses from 35 to 40 feet, as allowable on state highways.

Highway Building at Record Level

More than \$3 billion will be spent by the various levels of government for new construction of highways this year—up 10% over 1952. But with inflated dollars eating up construction costs the record spending will not result in record amounts of concrete and asphalt in place. Highway commissioners, city engineers and others estimate the nation's highway needs for carrying 54.5 motor vehicles will not be met even at that rate of spending. In addition, construction expenditures will be placed side by side with another \$1.5 billion to go into maintenance and upkeep of the nation's road system. The total bill for con-

struction and improvement in 1953 is thus likely to zoom over the \$4.5 billion mark.

Outgoing US Roads Commissioner MacDonald stated that: "If we are to make our highways adequate within the next 15 years, an annual construction expenditure of \$4 billion is required. Allowing \$1.5 billion for maintenance our annual expenditure should be at least \$5.5 billion."

Priorities and Controls

All production controls under the Controlled Materials Plan have been lifted. The Defense Production Administration has been abolished. All construction curbs have been removed. Anyone can build anything without obtaining a Federal priority rating or "DO number." Thus, the green light has been given to public construction projects which have heretofore been held up by lack of necessary governmental clearances. The trick is to get on a mill schedule to insure delivery of tight materials such as structural steel. In some cases lack of cement has caused a slow-down in highway and street construction. Spotty shortages have developed in several construction materials across the country.

After June 30th, 1953, the only priority help that will be given to any agency is reserved for the Atomic Energy Commission and the Defense Department. City construction and State construction will have to take its chances in the open market alongside private construction.

How sanitary engineers and others can now get a direct commission in the Medical Service Corps—page 151. Jobs for Engineers, pages 22 and 132.



LOOK JOE! SAW SMOOTH — STRAIGHT OPENINGS
for PATCHES & TRENCHES with a ...
SAVE TIME — MATERIAL — MONEY by
"SAWING BEFORE BREAKING" with a ...

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ONE OF 5
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\$465

Save up to 50% in labor and material. Saw repair patches — water, gas, sewer and air line trenches in floors, streets, walks and highways. Save too, by sawing contraction joints in floors and highways ... eliminate costly hand forming and spalling.

"4 OUT OF 5" BUY CLIPPER CONCRETE SAWS. Three-Point Suspension (see below) ... the Patented Water Application which increases blade life and speed ... perfect balance and dashboard controls for operating ease and maneuverability — these are the reasons WHY — "4 OUT OF 5" Buy Clipper!

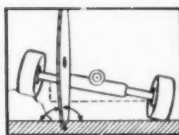
NEARLY 20 YEARS EXPERIENCE Sawing Concrete of All Types

The unqualified Clipper guarantee of satisfaction is backed by world-wide experience, the ability to select the finest materials and the "know-how" to put them together.



**YOU CAN DEPEND
ON CLIPPER
SUPERIOR
DIAMOND BLADES**

... guaranteed to ... "Provide the fastest cut ... at the lowest cost." Clipper alone can supply every necessary metal bond ... in over 36 specifications.



**THREE POINT "No-Bind"
SUSPENSION**

Three Point Suspension holds the blade straight and true in the cut — eliminates binding — drifting — sidewear and friction. Guarantees the **longest possible blade life!**



Look! Stop excessive
breakout and high cost!



Look! Stop excessive
breakout and high cost!



Look! Stop excessive
breakout and high cost!

Only minimum replacement material needed and is poured to straight, smooth edges.



Sawed lines confine breakout fracturing and speeds removal up to 50%.



Contraction joints in floors or streets eliminates spalling. 50% less seal and are maintenance-free.



CLIPPER MASONRY SAW

... the **ONLY** saw in the world that will cut masonry materials of every size and description. Clipper outperforms them all for **ONLY** Clipper is "CONVERTIBLE" and has the Patented Features for Flexibility. A Clipper Model to fit any job — any budget. Sold on **FREE TRIAL** ... Priced from \$265.



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ORDER TODAY ... on **FREE TRIAL**. Discover for yourself how Clipper will increase your profits by increasing your production at reduced costs. Clipper "ON THE JOB" **FREE TRIAL** guarantees satisfaction at no obligation.

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"SAW SMOOTH THRU"

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Recommendations on Insecticide Use to Prevent Development of Resistance

DURING the past few years, there have been slowly increasing indications from several scattered areas in the world that some species of *Anopheles* are developing resistance to DDT. Some evidence has been developed by workers of the Tennessee Valley Authority that *Anopheles quadrimaculatus* may be developing resistance to DDT in some localities in which DDT has been used continuously for more

than 5 years. However, in general this species does not appear to have developed resistance to DDT to a degree which would significantly affect control operations. The continuation of previously adopted procedures for the control of *A. quadrimaculatus* is recommended for 1953, namely, the use of 5-percent-DDT emulsion residual sprays in homes, and a 5-percent-DDT emulsion or a 5-percent-DDT oil solu-

tion for outdoor space spraying to control adult mosquitoes.

Such data as are presently available on the development of resistance by both mosquitoes and flies indicate that resistance develops more rapidly when both the larval and adult stages are exposed to chlorinated hydrocarbon insecticides. Therefore, it is recommended that larviciding with DDT or other chlorinated hydrocarbons be employed for the control of *A. quadrimaculatus* only in those situations where this method offers the only practicable means of control. Where larviciding is indicated, the recommended procedures are the use of 0.05 pound of DDT in 1 gallon of fuel oil per acre for larviciding with hand sprayers, and the use of 0.05 to 0.10 pound of DDT per acre, applied as a 20-percent solution in methylated naphthalenes, such as Velsicol NR70 or Sovacide 544B, for airplane treatments.

The only known mosquito vector of disease which appears definitely to have developed a high degree of resistance to insecticides in the United States is *Culex tarsalis* in California. Observations by the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture indicates that in some localities this species has developed varying degrees of resistance to a number of chlorinated hydrocarbons, including DDT, toxaphene, lindane, aldrin, and heptachlor applied as space sprays.

Against some species of pest mosquitoes which have not developed resistance to DDT, barrier-strip residual spraying with DDT around the outside of individual premises has given effective control. In the Savannah, Georgia area DDT emulsions applied at the rate of 5 lb. per acre to the outside of houses, and to shrubbery, grass, and other vegetation for a distance of approximately 120 feet around the houses, gave satisfactory reductions against the common species of salt-marsh mosquitoes for about 5 weeks. It is recommended that similar procedures be used experimentally where other control measures are not more feasible. On the other hand, barrier-strip spraying around cities and towns has proved ineffective in preventing invasions of rice-field mosquitoes, *Psorophora ferox* and *P. discolor*, and salt-marsh mosquitoes.

The above data are from the Communicable Disease Center, USPHS, Savannah, Ga.

Resurfacing A Major Highway without closing it to traffic



with the H & B MOTO-PAVER



While designed primarily for resurfacing work on secondary roads and city streets, the *Moto-Paver* here demonstrates its efficiency in resurfacing a major highway. Traffic was maintained on this highway—one of the busiest in the East—while the work was being done. The lower picture shows aggregate being dumped into the *Moto-Paver* hopper on the job.

The *Moto-Paver* does the complete mixing and laying job—in one continuous operation, using beach sand, gravel, crushed stone or slag aggregates, and tars, cutback asphalts, road oils, emulsions or other bituminous materials. Road speeds up to 25 mph make possible quick moves from job to job. For specifications and complete information see your local H & B distributor or write for Bulletin MP-43.

HETHERINGTON & BERNER INC. • Engineers—Manufacturers
700 Kentucky Avenue Indianapolis 7, Indiana

Komac* Premix

applied quickly . . . easily in any kind of weather



THE PATCH under the moving truck was opened to traffic immediately. Notice, too, that Komac Premix does not stick to tools.

THIS new, easy-to-apply road patching premix can be used all year round . . . rain or shine, hot or cold. Just sweep out the hole and patch with KOMAC Premix . . . compact thoroughly, then open to traffic.

KOMAC Binders, offered exclusively by Koppers, mix easily and quickly with local aggregate. Since KOMAC Premix stays workable in the stockpile for a year or more, it is immediately available for use when you need it most.

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Tarmac®

For road building or resurfacing

TARMAC resists the stripping action of water . . . even withstands the softening effect of gasoline and oil drippings.

You can speed up construction work with TARMAC, because it penetrates quickly into roadbeds, mixes easily with local aggregate, adheres quickly and cuts through dust and moisture films to coat the aggregate.

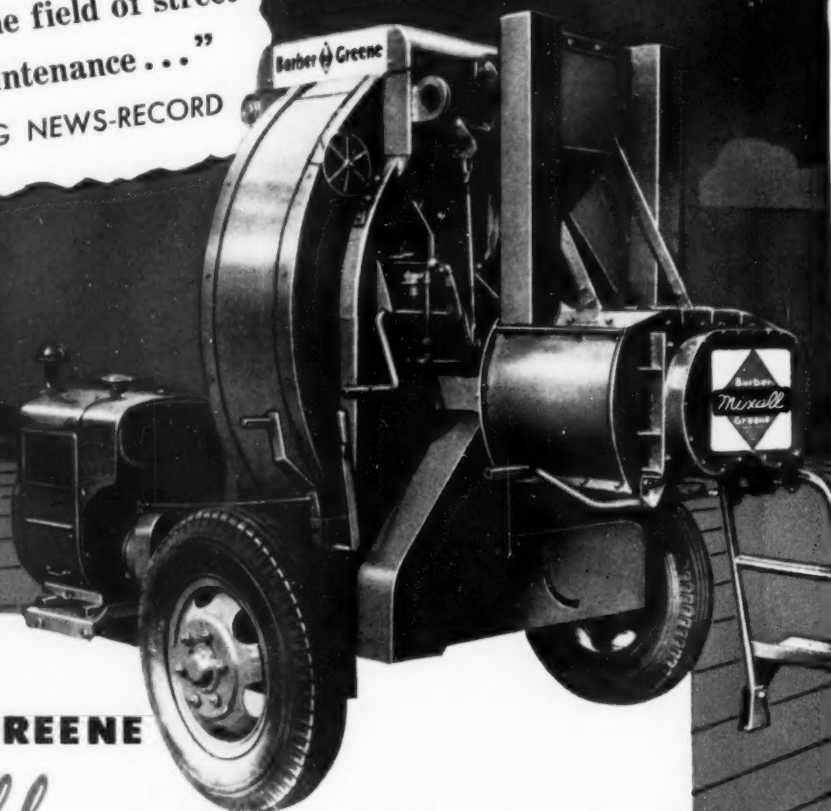
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development in the field of street
and highway maintenance..."
—ENGINEERING NEWS-RECORD

Barber-
Mixall
Greene



**THE NEW
BARBER-GREENE**

**Mixall MEETS THE NEED FOR ALL
MAINTENANCE AND SMALL PAVING JOBS**

The quotation at the top of this page is typical of impartial observers who have seen the new Barber-Greene MIXALL perform. There is widespread agreement among editors, road builders and government officials that the need for a machine capable of on-the-spot production of even the highest type hot mixes has been answered by the development of the MIXALL. Primarily designed for "stitch in time"

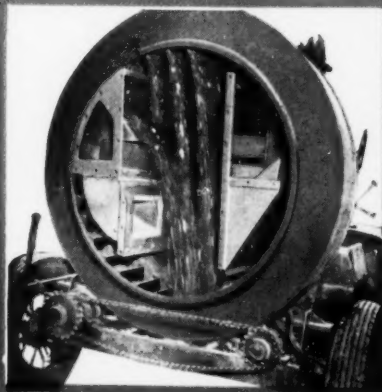
maintenance to prevent major break-ups of much needed roads, the MIXALL also opens the market for surfacing of sidewalks, driveways, parking lots, service stations, playgrounds and countless others.

Once you see the MIXALL perform, you'll quickly recognize the business-building possibilities it holds for you. See your Barber-Greene Distributor for the full story—or write for information.

see your **B-G distributor** ...or write

"BIG PLANT" Principles—

...WITH NO COMPROMISE IN DESIGN



Rotary Drum Drying

Proved, efficient rotary drum dryer. Aggregate falls in a thin veil through a blast of hot gases which removes and drives off all moisture. Same principle as largest B-G dryers.



Pressure Mixing

Twin shaft heated pugmill insures pressure "knading" action. Far superior to tumbling action or screw conveyor principle. Assures thorough coating of each particle—no dead spots. Mixes lowest slump concretes.

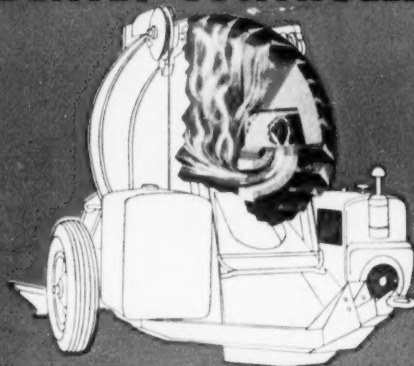
SIMULTANEOUS *Drying and Mixing*—

...BOTH CYCLES INDEPENDENTLY CONTROLLED

Independent control of drying and mixing, with both cycles operating simultaneously, achieves exactly the dryness and mixing time desired. This is vitally important to the successful production of high-type hot patch materials.

Hot patches are essential because: (1) they are less susceptible to the inroads of water; (2) they adhere more effectively to bituminous or concrete areas surrounding the patch; (3) they may be opened to traffic immediately—no curing period is required.

To get the best hot patch material, efficient drying is essential. The Mixall provides a B-G rotary drum dryer, the most effective dryer. It enables you to gain the many benefits of using hot patch materials.



Look

AT WHAT
YOU CAN DO

MIX ALL QUANTITIES: from a single 300 lb. batch up to 5 tons per hour of hot mix—or up to 10 tons per hour of cold patch.

MIX IN ALL LOCATIONS: towed to the job by truck loaded with aggregate . . . fed directly from truck or from stock pile or pit. Works in a single traffic lane. No set-up time required.

MIX IN ALL WEATHER: heated aggregate makes low atmospheric temperature mixing possible—allows quick repair to prevent major failures.

MIX ALL TYPES: of bituminous materials including stabilized mixes—as well as low slump Portland cement mixes.

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Descriptive 8-page
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in PATCHING PAVEMENTS properly

...use KOTAL STOCKPILE MIX

KOTAL STOCK PILE MIX is produced with graded aggregates under carefully controlled conditions. It is a tough, durable paving material that stays put . . . Can be laid in all kinds of weather . . . Is available at all times . . . Is economical to use . . . Available from suppliers' stockpiles the year 'round.

KOTAL MIXES specified by street and highway engineers for over 15 years.

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I am interested in the possibility of:

- ☐ Using Kotal Stock pile mix
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Obtaining Uncontaminated Bituminous Binder Samples

In various experimental and development work it is necessary to obtain a sample of bituminous material from a road surface which has been exposed to traffic and various climatic factors. Getting a sample which was not contaminated with the underlaying material has been very difficult.

The English Road Research Laboratory has solved this problem by laying a membrane of polythene sheeting on the road surface and treating over it with the bituminous material. For a recent experiment a series of 12-inch square sections of the membrane were placed on the road surface and a tar binder sprayed over them with the usual covering aggregate. Sections were removed at monthly intervals and tested for viscosity. It is reported that the sections were easily lifted from the road and a tar sample obtained which was free from contamination with material from the original road surface.

• • •

An Experiment in Sludge Digestion

At the Detroit, Mich., sewage treatment plant, an experiment was set up to determine how quickly the early digestion of raw sludge would separate solids from the liquid. The experiment was run in one of the plant grit channels. Raw sludge was seeded and heated to about 95°. At an air and sludge temperature of 62° to 79°, the following reactions took place: (1) In 48 hours the sludge had settled to the bottom and water appeared on top; (2) In the next 72 hours, the positions of the solids and liquid were reversed, with 2.5 ft. of water and 1.5 ft. of floating sludge; (3) 2.4 ft. of water were drained off. The sludge analyzed 24.8 percent solids and 47.4 percent volatile.

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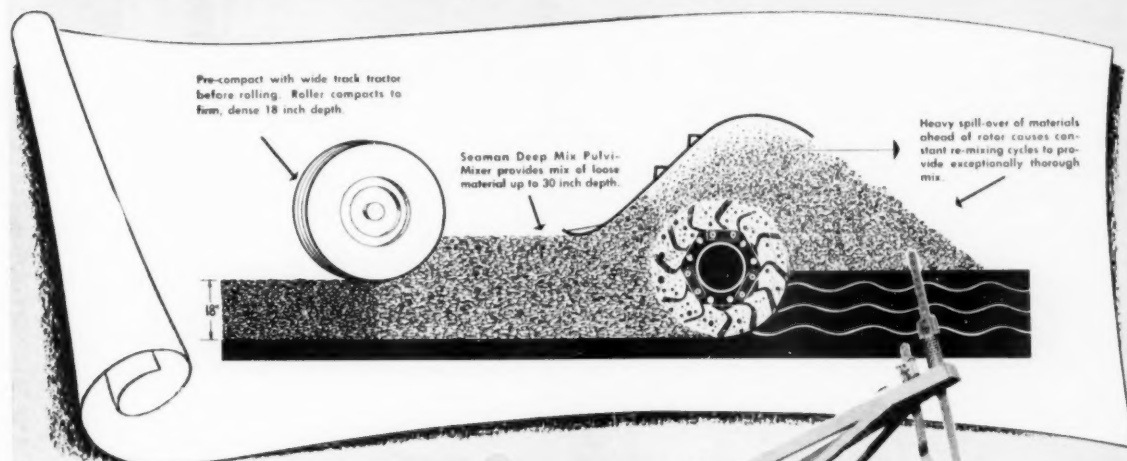
Cost of Installing Water Meters

Costs of installing various sizes of water meters was reported by the Detroit, Mich., Water Department for the fiscal year ending June 30, 1952. For 5/8-in. meters average cost was \$19.86 each; for 3/4-in. meters \$29.17; for 1-inch \$43.06; for 2-inch \$118.19. These costs include labor and cartage and material.

for an enduring base...

Stabilize the Subgrade with the

SEAMAN Deep Mix Pulvi-Mixer



The Seaman Deep Mix Pulvi-Mixer is mobile, versatile, fast, simple and efficient. Its low investment and low operating costs will save you money.



The Seaman Deep Mix unit clearing future airfield installation of palmetto.

A postcard will bring you further information and specifications of the Seaman Deep Mix Pulvi-Mixer. Mail your request today.

SEAMAN
MOTORS
Inc.

266 N. 25th St. MILWAUKEE 3, WIS.

Highway grade lines often cross cuts and fills exposing a variety of soil types. These react differently to freezing, moisture and heat causing instability. So great is the variation in movement of these subgrade soils that a concrete pavement — or any type of base course laid on it may heave, crack or otherwise break up.

The SEAMAN DEEP MIX PULVI-MIXER mixes and blends all soils up to a 30-inch loose depth. This destroys the identity of the various soil types, provides a homogeneous mixture and establishes uniform reactions to the natural forces that affect the subgrade.

Likewise, by mixing and blending gravel into the subgrade soil, the shock and load-bearing values are greatly improved . . . In clay soils, 2 to 3% of Portland cement, lime or similar additives may be mixed-in to reduce the plastic index and assure permanent stability. 30 inches of loose material compacts with a roller to an enduring uniform sub-base 18 inches in depth.

Land Clearing — Because of the ruggedness of the Deep Mix SEAMAN, it is widely used in clearing land of brush and small trees in constructing and maintaining power line right-of-ways, fire lanes and for clearing air base sites.

Thousands use our Readers' Service card to keep up to date . . . do you?

PUBLIC
WORKS

DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

**Paper Snow
Fence in Michigan**

Michigan State Highway Dept. began testing the use of paper for snow fences in the winter of 1949-50. It has made some changes and has set up 19 miles of such fence. The paper strips used are 12 in. wide and 300 ft. long, consisting of two layers of paper such as is used for curing concrete, cemented together with asphalt and reinforced with hemp on glass fiber. The method of fastening the paper to the fence posts has been changed from stapling to wooden strips attached to the posts, to pressing it into the groove of the steel post by a strip of wood. The paper costs 1/5 as much as an equal footage of wooden-slat fence, and handling costs less.

"Michigan Expands Test of Paper for Snow Fence;" *Engineering News-Record*, April 16

**Traffic Paint
In California**

California spends approximately \$700,000 a year on its traffic lines. Some years ago the highway department developed the "California formula" for paint for this purpose. It gave good service on its asphalt pavements until 1951, when shortage of the ingredients necessitated a change, and new formulas were tested on the roads and by an abrasion apparatus. Bids were invited on five different types of paint—Manila resin and chinawood oil; Alkyd; dispersion resin; modified phenolic resin, castor oil, chlorinated rubber; and chinawood oil—pentalyn varnish—chlorinated rubber. The last type was adopted as the state standard. The alkyd type performed well in the interior sections of the state but failed quickly in the coastal areas. The chlorinated rubber used in the adopted type (known as "Parlon") aids greatly in

reducing the initial drying time. Combined with the chinawood oil it offers a tough film of good durability and abrasion-resisting character. The average effective service life is from 6 to 10 months, depending on the location and time of year it is applied. Like all other types tried, it does better on asphalt than on portland cement. In 7 to 10 minutes after being applied it is dry enough to permit traffic to run over it without being picked up. The state uses about 45% pigment volume concentration, a compromise among the requirements for good visibility, durability and ability to hold glass beads; where beads are not used, a higher percentage is desirable.

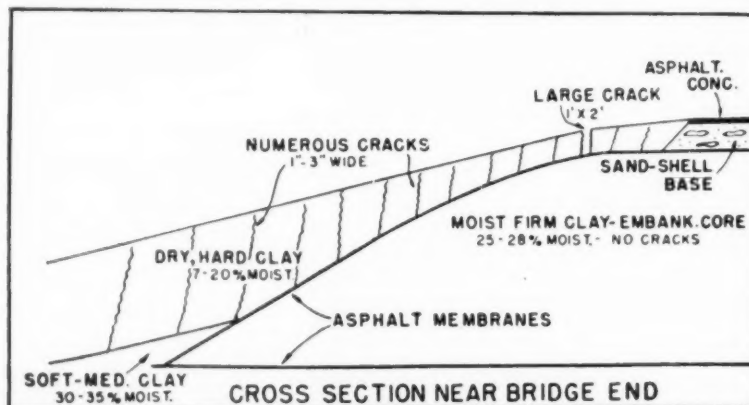
"Traffic Paint;" by E. D. Botts, Sr. Chem. Testing Engr. *California Highways*, April.

**Asphalt Membranes
Envelop Embankments**

In constructing the Gulf Freeway from Houston toward Galveston it was necessary to construct a total of more than 2 miles of fills averaging 10-ft. maximum height and from

60 to 200 ft. wide. The local soil used for the fills had very adverse shrinkage characteristics which would cause serious cracks in a concrete pavement laid on it unless the moisture in the fills were stabilized. Stabilization was obtained successfully by enveloping each fill, bottom, sides and top, with an asphalt membrane. Tests show negligible moisture change in the enveloped embankments over a 5-yr. period.

In constructing an embankment, all sod and top-soil was stripped from the fill area, which was then compacted with sheepfoot rollers and covered with 3/16 in. of 50-60 penetration paving-grade asphalt cement. When this had cooled it was covered with 6 in. of loose soil, followed by embankment compacted to 100% Proctor density. The slopes were cut back to solid embankment with a 1 1/2:1 slope and covered with an asphalt membrane which joined that extending from under the embankment. Soil was then placed over the sides to give 4:1 or flatter slopes. To learn the effectiveness of this construction, samples of the embankment soil are taken at regu-



Courtesy Roads & Streets

● SHRINKAGE cracks in clay formation.

Putting in culverts without putting out taxpayers



The Caterpillar HT4 Shovel is a sturdy, tireless unit engineered to deliver 100 cents of work for every dollar of tax money.

In Lancaster County, Neb., L. W. Weaver, county engineer, reports: "If we didn't have this equipment, we wouldn't have been able to put in culverts and 350 miles of road in the last five years."

High praise, sure, but not unusual. This handy Cat® HT4 Shovel is a one-machine answer to culvert placing. It digs the trench, lays the culvert, then backfills, levels and regrades.

When it isn't putting in culverts for Lancaster County, it keeps busy loading rock for the county crusher. It's an important member of the Caterpillar team of equipment owned by Lancaster County, which includes motor graders, D7, D6 and D2 Tractors.

The Cat HT4 Shovel is designed to do a multitude of city and county jobs . . . to absorb punishment the year around . . . and to see the jobs through.

Its all-welded lift arms are box-section. Girder-type, all-welded frame is mounted low and close to the rollers to keep the load off the transmission and tractor frame. A spacer bar between the lift arms stops twisting and bending of the lift and bucket control arms.

Ask your Caterpillar Dealer to demonstrate the shovel that will make your budget look good. Its speed of operation and quality manufacture make it a smart investment.

Caterpillar Tractor Co., Peoria, Illinois.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks - ®

**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**

lar intervals. The moisture content, originally 15% to 27% at differing points, has changed a maximum of 4%, in many places remaining constant. All membranes were found to be "alive" and unchanged. The fill outside the membrane shrank, and cracks formed; one crack was more than 12 in. wide and 80 ft. long, and extended down 2 ft. to the membrane, but the membrane itself was not torn open.

"Asphalt Membranes—Their Service Record on Gulf Freeway Fills;" *Roads and Streets*, April.

Patching Asphalt Streets in Nashville

Nashville, Tenn., has found repairing utility cuts and cracks in asphalt pavements a difficult and expensive problem, but has developed a method that they consider satisfactory. When a public utility has made a cut, the superintendent of streets replaces the pavement over it, first with a temporary patch; and six or more months later, when the backfill is supposed to have stopped settling, this is replaced with a permanent patch. The temporary patch is made with a cold mix material, which is pre-

pared at a central point 400 to 500 tons at a time, using AE-90 modified. The permanent hot patch is made in two layers; the first with 1½-3% in. stone and 5 to 7% emulsion; the top course is 50% Alabama rock asphalt, and 50% sand with 10% emulsion. These are mixed in a McConaughay portable hot asphalt patch mixer, and rolled with a small roller. Cost data were obtained on a patching job on 3600 ft. of sand asphalt 46 ft. wide, in which there were 136 patches with a total patch area of 636 sq. yd. On this job the labor cost was \$1844.60, material \$923.20; and, allowing 10% for general supervision, the total cost averaged \$6.00 per sq. yd. 4 in. thick.

"How We Do a Better Job of Street Patching;" by Warren A. Coolidge, Dir. of Pub. Works. *PUBLIC WORKS*, May.

Sawed Contraction Joints

In constructing 730,000 sq. yd of concrete pavement at the Lockbourne Air Force Base, Columbus, O., in 1951 and 1952, 250,000 lin. ft. of transverse joints were made by sawing to a depth of one-fourth the

thickness of the pavement, which ranged from 6 to 12 in. The advantages anticipated from sawed joints were: that they provide a better surface for traffic, avoid damage due to manipulation of the concrete by hand-forming while the concrete is hardening, permit a better sequence of operation during construction, permit earlier application of curing compounds, reduce the quantity of joint-filling material required, and present a better appearance. While sawed joints are narrower than hand-made ones (1/8 to 3/16 inch), there was no difficulty in applying ordinary filler, but jet-fuel-resistant fillers have a narrow temperature range for application and have to be filled in several stages. The time required to saw a joint 3 in. deep and 25 ft. long was about 6 min. Sawing was delayed until the concrete had hardened to a stage where no damage would be done to the surface, but before voluntary cracking of the slab should occur. No definite time between placing of concrete and sawing of joints could be determined, but the major factors controlling it were the weather and temperature, quantity of cement per

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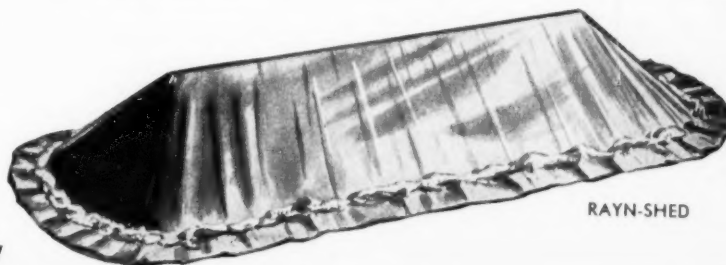
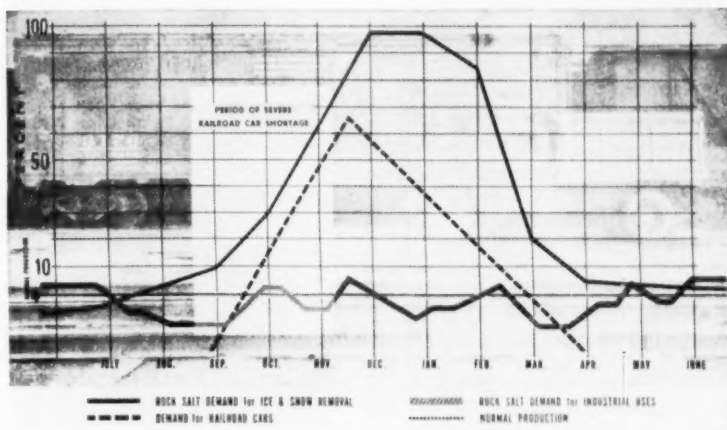
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(Sand mixed with sodium chloride)

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Loading	.25
Haul, 5 miles at 8c	.40
Piling with bulldozer	.15
Treating with salt (50 lbs.)	.48
Reloading at time of storm	.25
Average haul, 10 miles at 8c	.80
Spread	.10

Total cost per cubic yard \$2.53
Cost per mile (3 cu. yd. at \$2.53) 7.59

Cost per 5-ton load:

5 tons bulk salt at \$12.95 per ton	\$64.75
Loading, 5 tons at 25c per ton	1.25
Average haul, 5 tons, 30 miles at 8c per ton mile	12.00
Spread (mechanical) 5 tons at \$1.00	5.00

Total cost per 5-ton load \$83.00
This is the cost for 25 miles of road 83.00
Cost per mile (\$83.00 divided by 25) 3.32

\$7.59 cost per mile with treated sand
3.32 cost per mile with Cayuga Rock Salt

\$4.27 SAVINGS per mile with Cayuga Rock Salt

This report is from F. Ray Williams, Superintendent of Highways, Saratoga County, N. Y. Total mileage of state highways in this county: 216 miles. Estimated savings, each storm, 216 x \$4.27, or \$922.32.

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cu. yd., and type of concrete. The elapsed time was generally 6 to 8 hr. on hot, windy days and 12 hr. of night. Sawing too soon produced a groove with ragged edges and slowed the cutting.

"Contraction Joints Sawed at Air-field;" by Karl Vogel, Corps of Engrs., U. S. A. *Contractors and Engineers*, April.

Trenching Material for Sand-Clay Road

In Mitchell County, Texas, much of the country is covered with wind-blown sand, and sand dunes collect along the fences lining the road and during dry weather the roadways become sand bogs and in wet spells become wet bogs, since the sand is underlain by clay. Road Commissioner Bodine has developed a method of mixing the underlying clay with the sand and making a serviceable sand-clay road. To effect this, a trencher digs a ditch 27-in. wide, 12 ft. each side of the center line of the roadway. The sand is about 2 to 3 ft. deep, and the trench is dug to a depth twice that of the sand so as to give a 50:50 mix of clay and sand. The trencher deposits the excavated ma-

terial in two piles between the two trenches. A grader fills the trenches with sand from the sides of the road, and spreads the two windrows of excavated material and mixes it to form a roadway 24 ft. wide and crowned 24 to 36 in. above the original surface. If more material is needed, it is obtained by digging another trench. Where possible, fences along the road are eliminated to prevent the formation of sand dunes.

"Trencher Builds Low-Cost Road in Texas;" *Engineering News-Record*, April 30.

• • •

Biofiltration

(Continued from page 65)

sider the output of the single stage plant using flowsheet of Fig. 5 as the feed to the second stage of a two-stage plant. For predicting the performance of the second stage, Fig. 8 may be used. This method for predicting performance assumes that the sewage of the first stage is less "treatable" as it enters the second stage which is probably true when only settled filter effluent from the first stage passes to the second stage.

In Fig. 6, however, this is not the case as the feed also includes some primary settled sewage which has not been through any filter. Thus, its "treatability" has not been impaired to the same extent if at all. A study of the performance of the two-stage plants utilizing this flowsheet seems to indicate that the second stage may be considered to perform as a primary or first-stage filter in amount of BOD removal. For this reason, Fig. 7 is more applicable as it more closely fits the conditions.

An illustration of the compact arrangement with short piping connections which can be obtained with this flowsheet (Fig. 6) is shown in Fig. 9, which illustrates the general arrangement of clarifiers and filters at the Orlando, Fla., plant. In this flowsheet a constant quantity equal to average Q plus primary recirculation is passed through the primary Biofilter and returned to the primary influent. Volumes equal to the incoming sewage with all its variations is withdrawn from the primary circuit and passed over the diagonal sill of the control chamber to the secondary Biofilter and thence to the final clarifier. A constant volume of recirculation from the final clarifier is automatically measured

heavy duty on the spot!



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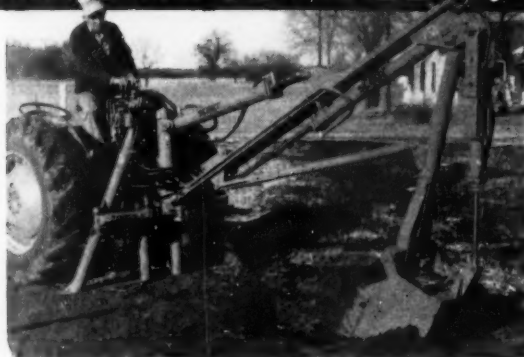
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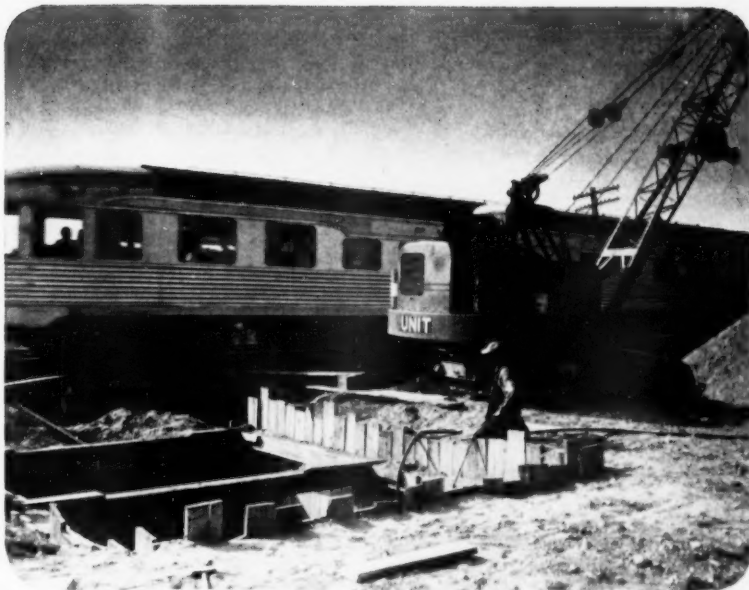
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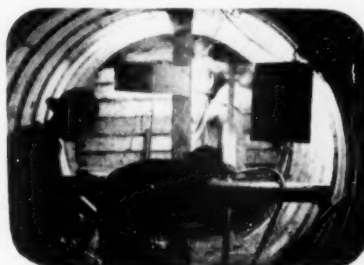
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ARMCO LINER PLATES



TABLE 2—OPERATING RESULTS AT ORLANDO

Ave. Daily Flow	3.891	Mgd
BOD 5-Day		
Raw Sewage	176.1	Ppm
Primary Effluent	38.1	"
Final Effluent	10.6	"
Suspended Solids		
Raw Sewage	134.0	Ppm
Primary Effluent	28.9	"
Final Effluent	6.7	"
Removals		
BOD	94	percent
Suspended Solids	95	percent

and collected by means of the "doughnut" launder surrounding the influent well, and is pumped to the downstream side of the control chamber for return to the secondary Biofilter. The primary Biofilter thus receives a constant flow while the secondary Biofilter receives a variable flow. This requires slightly more head to operate the Distributor than for the constant flow unit. For this reason the secondary filter must be located about a foot lower than the primary filter.

For the first year's operation, after an initial tuning-up period, the Orlando plant treated slightly less than

half its design capacity. The results of operation furnished by Mason S. Nagel, Superintendent, are shown for 12 consecutive months in Table 2.

Few plants of any type can equal this performance, and with experience the plant should readily treat up to its design capacity and turn out a continuously acceptable effluent.

As a check, it is interesting to compare the actual results with computed performance using the method described above for evaluation of this particular flowsheet. The 1944 Tentative Standards were used for this evaluation with the results shown in Table 3.

One of the essential requirements for maintenance of uniform quality of final effluent in a high rate filter plant is continuous withdrawal of humus sludge. Allowing this to remain in the final clarifier is certain to result in deterioration of the effluent. The dissolved oxygen decreases and the solids become partially septic and gas buoyed, whereupon they rise to the surface and pass out into the effluent. Many designers do not pay sufficient attention to this detail and the plant ef-

TABLE 3.—ACTUAL AND COMPUTED RESULTS, ORLANDO, FLA.

	Actual	Computed
BOD Raw Sewage	176.1 Ppm	—
Settled Sewage	38.1 "	44 Ppm
Final Effluent	10.6 "	12 "

fluent suffers. This humus sludge can always be returned to the primary for consolidation so that its moisture content is of no consequence. As a matter of fact, many designers provide recirculation from the underflow of the final clarifier, thus assuring continuous removal of the humus sludge and its return to the primary.

Nitrification

The effluent from any high-rate filter plant, however low in BOD content, seldom contains any evidence of nitrification. In many locations this is of no consequence for one reason or another; either the receiving stream is adequate to absorb the effluent, or within the 5 days during which the BOD will develop, the effluent will have travelled to a stream which does have adequate capacity. However, vari-

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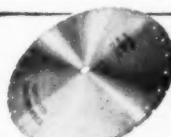
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ous agencies which stipulate the effluent requirements do at times insist on a well nitrified effluent for specific areas, and require that a plant constructed in such areas shall be capable of turning out a nitrified effluent. The midwest with its dry summer streams has many communities which must discharge their sewage into streams which are said to be incapable of absorbing it without complete nitrification.

Heretofore, the usual method of treatment employed for these conditions has been the low rate filter. Low rate filters are commonly

loaded at 400 to 500 lbs. of BOD per day per acre foot compared to 2000 to 3000 lbs. per acre foot for high-rate filters. This means that in order to obtain the required nitrification, but not necessarily any better appearing effluent, a community must construct filters with 5 or 6 times the volume of filter media required for high-rate filters. Where the small community happens to be the home of food processing industries, such as canning or dairy products, upon whose success the welfare of the community depends, the cost of sewage treatment can seriously af-

fect the local economy. Now, fortunately, such industries are joining with the community to find an economical solution.

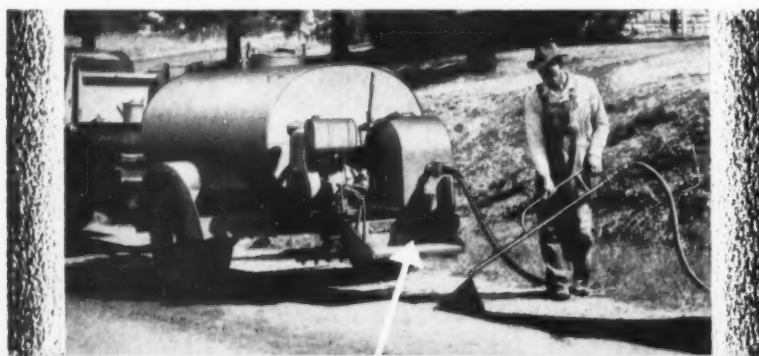
One solution has been found which greatly reduces the filter requirements and yet yields the quality of effluent of the low-rate filter. This involves use of a high-rate filter, called by some a "roughing" filter, as the first stage, and a low rate filter as the second or final stage. Flowsheet Fig. 3 is usually used with the secondary filter, a low rate unit, and with sufficient second stage recirculation to maintain a minimum dosing rate on the filter. In one midwestern community where a local industry contributed over five times the BOD that the community itself did, if low rate filters had been used exclusively, a volume of 8.7 acre ft. of filter media would have been required. Using the high-rate filter in the first stage reduced the requirements to a total volume of only 3.5 acre ft. This represents a saving of 5.2 acre ft. or about 60% of that required for a complete low rate filter installation. Assuming 6-ft. filters, the area saved is 37,800 sq.ft., equivalent to a circle 222 ft. dia. Operating results show this plant to be producing an acceptable nitrified effluent. Flowsheet Fig. 6 could also be applied to this problem with a low-rate filter as the second stage, resulting in still further economy. High-rate filters are also frequently installed to relieve overloaded plants.

The economy of Biofiltration has been well established not only in first cost but in operating cost. Operating costs for the biologic treatment step using high-rate filters are in general less than for other equivalent methods of treatment. This can be proven by using accepted units of performance and computing operating power requirements.

The overall proven advantages of Biofiltration as demonstrated by hundreds of plants have made it the ideal solution to the treatment problem for the average community.

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- R. S. Rankin "Trickling Filters" Public Works, May 1947.



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FLUORIDATION EQUIPMENT AND FACILITIES

FOLLOWING studies and investigations of existing installations, New York State revised its requirements for water fluoridation equipment and facilities earlier this year. These revised requirements are given herewith, with occasional modifications in the official terminology used.

Fluorine Compounds—Commercial sodium fluoride, sodium silicofluoride, ammonium silicofluoride and hydrofluosilicic acid are acceptable for the fluoridation of public water supplies, provided ammonium silicofluoride is not used in the treatment of a water supply which also is chlorinated. Other fluorine compounds which may be made available for water fluoridation purposes may be approved, provided definite evidence is presented that they are satisfactory for the purpose, that they can be stored and handled in a satisfactory manner and that they can be applied with the necessary degree of precision with the proposed chemical feeder. The use of granular compounds is advocated to minimize dust when handling the fluoride materials.

Chemical Storage Facilities—The fluorine chemicals should be stored in covered or unopened shipping containers such as 100-lb. paper bags, fiber drums or wooden barrels, unless the chemical is discharged when received into an approved covered storage hopper. Provisions should be made for the installation of covered storage hoppers or bins of chemical feeders of sufficient size so that it will not be necessary to add chemical to the hopper or bin more than once each day. The use of pneumatic conveyor equipment for the transfer of chemicals from shipping containers to storage bins is recommended for large installations. Fluorine chemicals should be stored in a reasonably dry space. Hydrofluosilicic acid must be stored in unopened glass carboys or rubber-lined shipping containers to prevent the release of gases or vapors.

Chemical Feeders — Chemical feeder accuracy should be within approximately 5 percent of the intended dose. Proportional feeders, controlled by suitable metering de-

vices, should be provided where the rate of flow of water being treated varies more than about 10 percent from the normal rate. The chemical feeder must be synchronized to start and stop with the flow of water being treated when pumps are operated automatically. Scales or loss-of-weight recorders must be provided. The floor surfaces surrounding chemical feeders should be smooth and impervious or metal-clad.

Solution Feeders—Solution feed equipment, such as altered hypochlorinators or accurate chemical pumps, may be used to apply solutions of sodium fluoride or ammonium silicofluoride, or concentrated hydrofluosilicic acid, and also this acid after dilution when very soft diluting water is available. Approval will not be issued for the feeding of a slurry of sodium silicofluoride with solution feeders. The volume of make-up water used in preparing a solution shall be metered or measured. Unless expressly exempted, approval will not be granted for the discharge of a solution directly into the suction pipe of a pump or other pipe or conduit or basin which normally operates under atmospheric or negative pressure. Furthermore, the discharge line of every solution feeder must be equipped with a valve, vacuum breaker or other approved device to prevent the back-siphonage of solu-

tion should negative pressure occur at the point of treatment. The pipe carrying dilution water should terminate at a point at least 6 inches above the spill line of the tank, unless some other approved method of preventing back-siphonage is provided. Preference will be given to the use of saturators for the preparation of saturated solutions using granular, pellet or tablet form of sodium fluoride, both to minimize the production of dust in handling the chemical and to simplify the preparation of solutions of definite strength.

Dry Chemical Feeders — Dry chemical feeders of either the volumetric or gravimetric type are acceptable. Chemical feeders must be completely enclosed and dust prevention precautions must be taken as indicated below. The solution pot of dry chemical feeders should be selected to provide effective solution of the chemical. The minimum amount of water to be made available shall be 12 gallons per lb. of either sodium fluoride or ammonium silicofluoride or 60 gallons per lb. of sodium silicofluoride. The solution pot should have a sufficient size to provide a minimum detention period of 5 minutes for sodium fluoride or ammonium silicofluoride solutions or 15 minutes for sodium silicofluoride solution. Precautions must be taken to prevent back-siphonage into the water supply. A vacuum breaker or its equivalent must be provided to prevent the content of the solution pot from being drained or siphoned into the water supply being treated when the unit is shut down. There should be no direct connection between the drain of a solution pot and a



● FACILITIES for feeding hydrofluosilicic acid at the Canton, Ohio, water plant.

sewer. Any booster pump needed to force a diluted solution into the water being treated should be fitted with all-bronze parts.

Protective Equipment—Specifications accompanying plans for water fluoridation equipment shall require at least one pair of rubber gloves with long gauntlets for all operators in any shift who will handle a fluorine compound and also shall require for such operators at least one dust respirator of the type approved by the United States Bureau of Mines for toxic dusts. The use of rubber aprons is advocated to protect the clothing. Washing facilities must be provided for hands, gloves and aprons.

Dust Control Equipment—Provisions shall be made for the disposal of empty bags, drums or barrels either by burning or by other procedure which will minimize exposure to fluoride dusts. Broken or leaky bags or drums should be immediately repaired or emptied at once into storage hoppers. A metal wheelbarrow should be available for the temporary handling of leaky bags. Provisions shall be made for wet mopping and the wiping of equipment so as to remove any fluoride dusts which might accumulate, unless a suitable type of vacuum cleaner is available for maintaining the floor and equipment free from dust. A floor drain should be provided to facilitate hosing of floors.

Provisions must be made for the proper transfer of dry fluorine compounds from shipping containers to storage bins or hoppers so as to minimize the quantity of dust which may enter the room in which the equipment is installed. The use of vacuum pneumatic equipment or closed conveyor systems; of facilities for emptying shipping containers in special enclosures; or the use of exhaust fans and dust filters to place the hoppers or bins under negative pressure is advocated for all dry feed installations, including small plants.

Plans and specifications for fluoridation equipment and facilities will be reviewed from the standpoint of proposed dust prevention procedures and approval will be given only when they consist of either one of the following:

(a) Vacuum pneumatic equipment for drawing powdered material from shipping containers to closed storage hoppers, the exhaust air from the system being filtered effectively and discharged to the exterior.

(b) An exhaust fan with dust filter and suitable ducts, the fan having a capacity sufficient to provide a velocity of flow of entering air of at least 200 feet per minute at the opening through which the compound is dumped into an otherwise closed hopper or bin or solution tank. The capacity of the fan should be selected with due regard to the area of this opening. The fan must be installed in the exhaust duct so that the hopper and dust filter enclosure will be under negative pressure.

(c) An enclosure forming an integral part of the chemical feeder into which a bag or a drum of a fluorine compound may be placed before the container is emptied into a hopper, bin or solution tank, so that the emptying process takes place within the enclosure.

(d) A special cover, fitted with a sliding gate, so proportioned that it may be securely attached to a drum of the powdered chemical in a dust-tight manner, after the regular cover has been removed, together with facilities for inverting the drum

directly over the opening in the cover of the hopper or solution tank so that the contents of the inverted drum will fall by gravity into the hopper or tank when the gate is opened, suitable gaskets being used to provide a dust tight connection between the special cover and the hopper or solution tank structure.

(e) A small capacity dry feeder fitted with a covered hopper where only small quantities of the crystalline or granular form of fluorine compound, none of which will pass a 200 mesh screen and not more than 15% of which will pass a 100 mesh screen, are to be transferred at one time into the hopper through the use of a small utensil like a sugar scoop.

(f) A solution tank or "saturator" containing water into which only the crystalline or granular form as defined above, or pellet or tablet form of the material is to be emptied to form a solution.

(g) Any other approved equipment which may be developed for use with any special shipping container or device which permits the

Separating Soft and Light Particles in Gravel

FIRST commercial production in this country of river gravel by the heavy media separation process has been announced by Keystone Division of Dravo Corporation, Pittsburgh.

Designed to improve the quality of river gravel for use as aggregate for concrete, the process removes by separation objectionable particles of "soft" gravel, porous gravel and foreign materials. Prior to tests of the heavy media principle, mechanical methods of scrubbing and pulverizing had been attempted for years, with high maintenance costs and only partial success.

The new process, which had previ-

ously been employed successfully in other fields, consists of placing the feed material—gravel dredged from the Ohio River—into an artificial heavy liquid made up of powdered magnetite kept in suspension in water. By varying proportions, a resulting liquid of any specific gravity between 1.0 and 2.5 can be maintained. All substances in the feed of lower specific gravity will float while heavier particles sink.

To retain the flexibility of its floating sand and gravel plants, Dravo designed and constructed a separate hull to carry the necessary equipment for the process. The specially designed hull is 50 feet wide, 40 feet long and 7 feet 6 inches deep. The plant is fed by a conveyor belt extending from the normal loading point on the dredge to a feed hopper at the top of the new plant. The finished gravel product is loaded onto barges moored alongside.

The plant was placed in operation in April, 1952, and operated during the 1952 season. While further tests will be conducted to verify results to date, considerable improvement in the quality of gravel has been noted. An important feature of the process is that it permits dredging for gravel in areas previously considered worthless because of contamination by coal and other deleterious material.



● DRAVO Keystone dredge produces gravel of improved quality.

transfer of the fluorine compound to an enclosed hopper, bin or solution tank of a chemical feeder without the release of dust.

Gas and Vapor Control Equipment—Hydrofluosilicic acid shall be stored in closed shipping containers. The acid shall not be handled in open vessels but shall be pumped in undiluted form from such containers through rubber or plastic hose to the water being treated in a manner which will prevent the production of gases or vapors; or the acid shall be pumped for dilution to a closed container fitted with a small vent, provided such dilution with the water available for the purpose has been approved as satisfactory. A suitable calibrated sight glass, or its equivalent, shall be used to permit accurate measurement of the acid and diluting water used. Preference should be given to the use of an approved diluting vessel sufficiently large to permit the total content of the container in which the acid is shipped to be transferred at one time and diluted with a measured amount of water so as to facilitate the preparation of a dilute solution of known strength.

Control of Water Fluoridation Process—The approved fluoridation of a specific public water supply should result in the desired concentration of fluoride ion of between 1.0 and 1.2 ppm, but the maximum concentration of fluoride ion in the treated water shall not exceed 1.5 ppm at any time.

It shall be the responsibility of the owner and responsible operator of the water supply being treated to collect samples of water for analysis at a frequency prescribed by the State Commissioner of Health from sampling points in the treatment plant before and after fluoridation and from selected points on the distribution system.

Accurate records of the amount of water treated and the weight of the fluoride compound applied to the water, and of the results of the analyses of samples for fluoride ion content shall be recorded daily on Form San. 131 or on any other approved form and these records must be submitted on or before the tenth day of the following month to the public health engineer having jurisdiction.

It shall be the responsibility of the local health officer or health officers to arrange for the collection of samples of fluoridated water for examination by a laboratory approved for the purpose at a frequency prescribed by the State.

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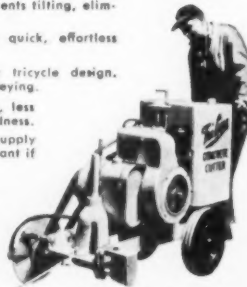


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DETROIT



Denver Water Works crew lowering 8" pipe. Five crews of 9 men each laid from 18,000 to 35,000 feet of new pipe per month (according to weather conditions) with the "QUICK-WAYS".



"QUICK-WAY" moves alongside trench backfilling as fast as men can tamp dirt. Note extra wide backfiller attachment which was specially built for this work.



8300 feet of new conduit was built in mountains to extend Denver's water supply. Here, two miles above sea level, a "QUICK-WAY" crane speeds work by moving heavy concrete forms.

"QUICK-WAYS"

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1,000,000 Feet of Water Mains

Denver Municipal Water Works install nearly 1,000,000 feet of new mains in 6 years. Use 7 "QUICK-WAYS" to handle pipe, digging, backfilling—many other tough jobs. Carl Anderson, City Superintendent, tells the story.

Saves Labor Costs of 51 Men—"Our department has used "QUICK-WAYS" since 1946. During that time we have laid almost one million feet of new mains ranging from 3" to 36". Had we still been using the "A" Frame Derrick, or laying by hand, it would have been an impossibility. Where we formerly employed 60 men to a crew, only 9 are needed now. And with the "QUICK-WAYS", they can lay 5 or 6 times more pipe.

Handles Many Tough Jobs—"We also used the "QUICK-WAYS" for backfilling trenches, loading trucks on cleanup jobs, dragline and clamshell work. When the ground got too spongy for heavy trenching machines, we moved in a "QUICK-WAY" with dragline bucket. Often times, this saved us a day or so delay. On line-leaks, we could pull a "QUICK-WAY" off a job many miles away—rush it to the trouble spot—and dig a hole in 3 minutes that would take a crew of men 5 or 6 hours.

Attachments Interchangeable in Minutes—"Another thing I like about a "QUICK-WAY" is that you can change attachments on the job in no time at all. And, it's a rare thing when one is laid up for more than just minor repairs."

"QUICK-WAY" Quality Construction—Denver is only one among many cities, counties and states using "QUICK-WAY" Truck Shovels to save time and work. "QUICK-WAY" gets to and from the job fast. Is quickly convertible—an attachment for every job with four booms. The Trench Hoe excavates, lowers tanks or pipe and backfills with one attachment. The Crane sets steel, loads or unloads logs, rails, materials, pours concrete, operates as a Magnet, Clamshell, Pile Driver, Hay Fork, Log Grapple, or Skull Cracker. Efficient too, as a Shovel or Scoop. "QUICK-WAY" has modern construction, all steel for strength and lightness, simplicity of design, numerous parts interchangeable, correct balance for truck operation, high capacity to weight ratio.

Tearing up a busy street to repair line leak calls for fast work. After breaking surface concrete with compressors, the "QUICK-WAY" backhoe dug a hole 6' x 4' x 10' in 30 minutes which would have taken 4 men all day.



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The Worst Roads in the World

The worst roads in the world—at least they claim they are—are used by the Army to test the strength of new army vehicles. There are 48 miles of these roads at the Aberdeen, Md. proving grounds, which are supposed to present the worst possible conditions under which the vehicles will ever be called upon to operate. A half-mile stretch has been so graded and paved that each of the vehicle's wheels is always at a different level from the others. For example, at a given time, the

left front wheel may be two feet lower than any of the others, while the left rear wheel is three feet higher than the right rear wheel.

Other stretches of paved road are composed of smooth macadam or concrete in which slabs of granite protrude at odd angles, to simulate a field filled with rocks. Then there are unpaved sections in which are slippery "S" curves, quagmires, ditches ten feet deep, stretches of sand and steep hills.

This would seem to offer a severe test not only of the vehicles but also of the drivers.

Timber Bridges

(Continued from page 69)

span length. In cases of three or more spans the deck is made continuous by staggering the joints in the laminations so that they fall in regular rotation at a support or at a quarter span point, as in the base of the composite slab described above. Lumber sizes commonly used are 8 and 10 in. wide by 2 or 3 in. thick. Either thickness is satisfactory, and the choice between the 2 and 3-in. material usually depends on relative costs. The lumber should be dressed S2S to insure a tight, interlocking deck. For a 20-ft. span length the 8-in. depth is commonly used for an H-10 loading, which is specified for many secondary roads. For heavier loading, such as H-15, a 10-in. depth is used. Adequate spiking is important in all cases. Spikes should be of sufficient length to penetrate at least two laminations, 50d or 60d spikes being preferred for the 2 and 3-in. material, respectively. Spikes should be in two horizontal rows and staggered, spacing in each row being generally 24 inches. Changing the pattern in the top and bottom rows in alternate laminations insures spiking on 12-in. centers.

Bridges of this type have been constructed in several states and assumed lateral wheel load distribution has varied from 3 to 5 feet. A lateral distribution of 3 ft. has been used by most of the Kansas counties in preparing their standards for this type of bridge. This figure was derived from a field test conducted in Kingman County, Kansas, on a longitudinal laminated deck bridge in 1938. The structure contains twelve 20-ft. spans built as a continuous deck with 3 x 8-in. laminations spiked together with 60d spikes. A truck approximating the assumed design load was placed on an uncovered deck of an end span. Later an interior span was tested. The resultant live load deflections measured under the wheels and at right angles to the roadway center line indicated a total lateral distribution per wheel of 7 to 9 feet. Deflections disappeared at points $3\frac{1}{2}$ to 4 ft. from the center of the wheel. The assumption of 3-ft. lateral load distribution was therefore conservative. The test also indicated that the simple span dead load moment is divided about equally between midspan and support, and that up to 60 per cent of the live load moment may be developed at

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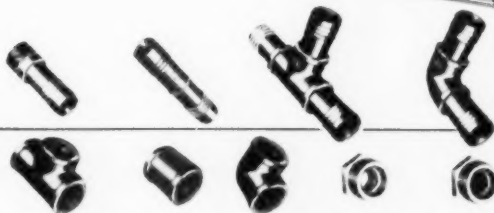


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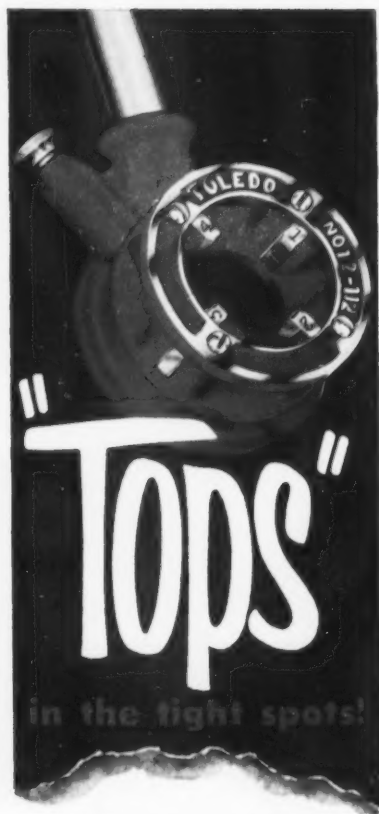
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either the support or at midspan.

The treated timber bridge construction work in Harvey County, described above, has been carried out under the direction of Paul D. Newcomer, county engineer, with headquarters at Newton.

In nearby Reno County, the county engineering department has recently completed a timber trestle bridge of still another type of design which involves the placement of a reinforced concrete floor on creosoted wood stringers. This structure, known as the Hendricks St. Bridge over Cow Creek, consists of seven 23-ft. spans of 22-ft. clear roadway between curbs. Each span contains fourteen 6 x 18-in. x 24-ft. stringers of incised Douglas fir for floor support. Spikes, driven to half of their length into the tops of the wood stringers, extend into the concrete floor to create partial composite action in the deck. The abutment backing is composed of 2 x 4-in. strips, laid flat and spiked together to form a tight, laminated wall to protect the approach embankments against erosion and stream scour. Previous experience here has shown backwalls of this kind to be very effective.

F. R. Rankin is the engineer for Reno County, with headquarters at Hutchinson.

The specifications of the Kansas State Highway Department are followed by the counties of that State in their own bridge work. These require that lumber be pressure treated with creosote. A final net retention of 10 lbs. per cubic foot is stipulated for lumber and 12 lbs. for piles.

• • •

Civil Defense

(Continued from page 74)

date plans for the plant, an analysis of the treatment processes should be made and the organic capacity of the receiving stream determined so that the minimum treatment essential to public health will be known. Possibilities for emergency treatment should be determined, as by chlorination, temporary settling tanks or lagoons, and the work and materials necessary should be generally outlined and estimated.

Industrial Wastes.—Plants discharging industrial wastes should be surveyed to determine the type of waste being discharged, the methods of disposal and the possible effect on public health in case of damage to the plant disposal facilities. In conference with the plant

managers, emergency methods of disposal should be developed where necessary. In the case of toxic wastes, special precautions may be required.

Chlorination.—The need for and availability of chlorination equipment for emergency use should be studied. This study may include a list of chlorination equipment makers or dealers, with an inventory of the usual stock carried. The possibility of home-made equipment for chlorinating sewage should be studied and plans drawn up for units of suitable sizes. The supply of hypochlorite in the community should be determined.

Report.—Upon completion of the survey and accompanying studies, a full report should be prepared for the local CD director, with definite plans and recommendations for meeting possible emergencies. These recommendations should cover needs for manpower, equipment and materials, and should outline the temporary or emergency steps that may be feasible, with a statement covering equipment and materials needs for each. Included in the report should be definite plans for locating emergency toilet facilities, with recommended sites and types of installations, as pit latrines or pail latrines (unless this is a responsibility definitely allocated to the health department). Sites may include park areas, alleys, manholes on large sewers, vacant lots or other open ground. Precautions should be taken in respect to location to prevent contamination of water supplies that are being used or may be used in case of emergency. Latrines will ordinarily be built by the CD engineering services and operated by the Emergency Welfare service. One seat should be provided for each 25 persons or less.

Also included in the report should be plans for guarding or blocking off areas flooded by sewage; repair of mains and services not requiring excessive labor, equipment and materials; and the possibility of utilizing or developing bypasses at key points.

Organization

The existing line organization of the department should form the basis for the emergency organization, with specific assignments of additional duties and responsibilities to the personnel. An organization chart should be prepared to show the duties and assignments of

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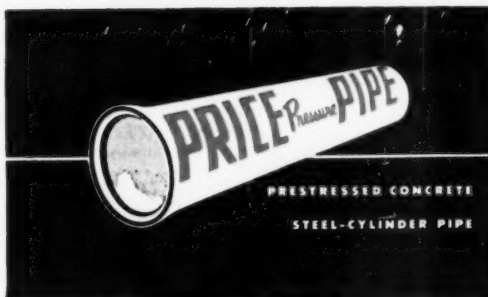
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all personnel, with a clear-cut line of authority and responsibility. This chart should include a list of replacements for all personnel in the target area; information where key personnel can be reached; and the best method of communicating with them day or night. A schedule should be prepared for 2 or 3-shift operation for 24-hour coverage.

The plan should provide that all personnel having a defense assignment within a zone should report immediately to the designated zone headquarters when an emergency occurs. This reduces travel and provides that the maximum number of men will be available at the earliest moment.

Since it will be necessary, in an emergency, to increase greatly the number of maintenance and repair crews, provision should be made for such large-scale expansion of the work by volunteer forces. Regular members of the department should be assigned as crew foremen. Training may be necessary for such volunteer personnel.

Copies of the organization chart and of the plan for work should be given to each man so that he can study it and understand his duties. It may be desirable to have question and answer meetings at which problems and procedures can be discussed and explained.


Emergency Training.—When the emergency program has been developed, an in-service training program should be initiated. This should apply particularly to employees whose emergency duties will differ from those that they normally perform. A training program of a limited scope will be desirable for the volunteer workers. All should receive instruction in civil defense. Most of the training can be carried on by sewer department personnel, but it should naturally be coordinated with the local civil defense program.

Equipment and Supplies.—Equipment and supplies necessary to meet emergency conditions must be determined on a realistic basis. For the most part, equipment needed for good day-to-day operation will be most valuable in an emergency. This may include, in addition to small equipment, portable pumps, duplicate chlorinating equipment and perhaps a standby engine to furnish power for essential parts of the plant equipment. Undue stocking of special equipment and extra parts should be avoided.

If it is considered that water and

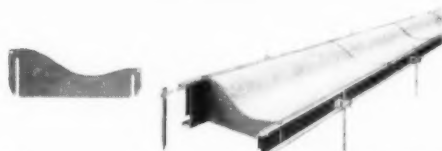
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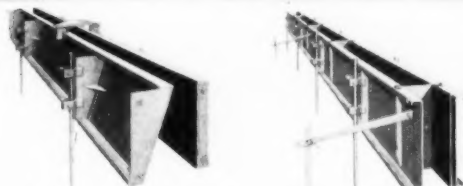


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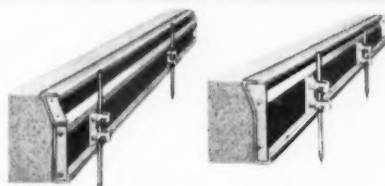
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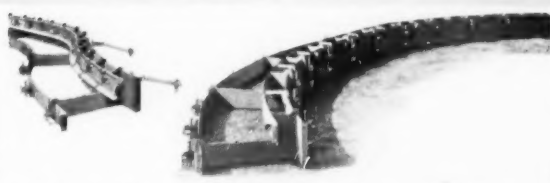
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sewage service will be disrupted in areas where the use of outdoor latrines is undesirable, plans may be made for stocking and using excreta disposal bags. These are water-resistant paper bags which can be inserted under the seat in a toilet bowl without the use of any special frame or container. After use, the top of the bag can be rolled down to make a compact package for later final disposal.

Reducing Radiation Hazard.—If an atomic bomb is exploded, radiological monitoring teams should be requested to determine if the con-

centrations of radioactive materials in the sewers and manholes and at the treatment plant are dangerous. If so, decontamination procedures should be conducted or supervised by trained decontamination teams. See FCDA publication: "Radiological Decontamination in Civil Defense," TM-11-16, March, 1952.

Decontamination procedures may introduce radioactive materials into the sewer lines. The runoff water from fire fighting might carry radioactive material into these lines, particularly into the combined sewers, and rain water runoff or drainage

might increase the contamination. The part of the contamination not held by the sewers or the growths in the sewers would be discharged to the sewage treatment plant, and in the treatment processes this radioactive material might be concentrated in the sludge. Contaminated sludges should be disposed of by burial, by isolation, or by discharging to a stream where the dilution is adequate as approved by the radiological defense personnel.

Post-Attack Operation

The previous paragraphs have dealt with sewage works personnel planning and preparations for a possible civil defense emergency. It is possible that information will not be available from the air-raid warning service in time to inform the public of an attack, so the emergency program must be planned to function efficiently without a warning period. It will be assumed here that: (1) an air-attack warning was sent out on short notice through the control centers, and (2) an actual bombing attack has taken place.

The Warning Period.—Following receipt of a warning from the civil defense control center, immediate steps should be taken to put the emergency operating program into effect. Procedures during such periods will vary, depending upon local conditions; there are, however, some basic steps which should be taken when an attack is imminent. These are:

(a) Key sewage works representatives should take their posts at civil defense control centers and maintain close contact with the other civil defense services.

(b) The sewage works officials in the offices and field headquarters should be notified immediately, and each employee should proceed to his assigned emergency station whether at alternate offices, field headquarters, plants or yards.

(c) Supervisory personnel in the field should be directed by telephone, radio, or other available means of communication to report to their emergency stations.

(d) Repair and operating crews should be contacted and instructed to go to their pre-designated emergency locations or to assume special assignments.

(e) Personnel at important facilities and plants should be advised of the emergency, and guards alerted.



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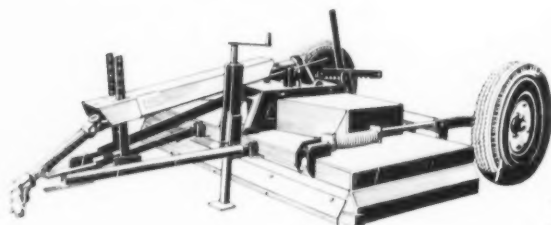
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Action After Attack.—Suggested procedures for key sewage works personnel after a civil defense emergency and the "all clear" signal has sounded are:

(a) Activate the alternate sewage works offices and operating headquarters and the alternate storage yards.

(b) Establish and maintain contact with the local civil defense zone control center.

(c) Determine where water supply is still available and the need for maintaining flow in sewer lines.

(d) Determine where electric power is not available and the effect on operation of sewage facilities.

(e) Determine the extent of damage to sewer lines, manholes, sewage pumping stations and sewage treatment plants.

(f) Determine the emergency overflow points that must be placed in operation.

(g) Advise downstream users where heavy pollutional loads are being discharged to surface waterways, and institute chlorination of raw sewage to these waterways if required.

(h) Dispatch repair teams equipped with materials and supplies, to make repairs at critical points.

(i) Determine extent of contamination of areas such as streets, basements and other low places, and initiate steps for de-watering and decontaminating important affected areas.

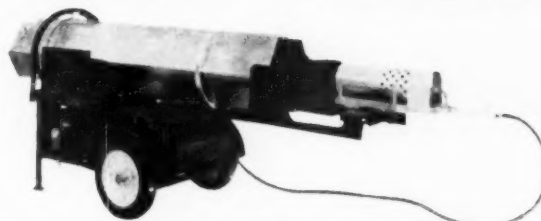
(j) When deemed necessary, arrange with the public information office at the civil defense control center to inform all customers where emergency toilet facilities are or will be available.

(k) Determine what material and mobile support is required, and request the chief of engineering services, through the sewage works representative at the local civil defense organization, to order this aid from the State civil defense director immediately.

(l) Carry out any other phases of the emergency program that may seem desirable.

Following an enemy air attack, close contact must be maintained through proper channels with the other services in the local civil defense organization. Information as to radiological contamination will be needed from the radiological monitoring services. The fire, rescue, and health services will move into the devastated area as quickly as possible. The transportation serv-

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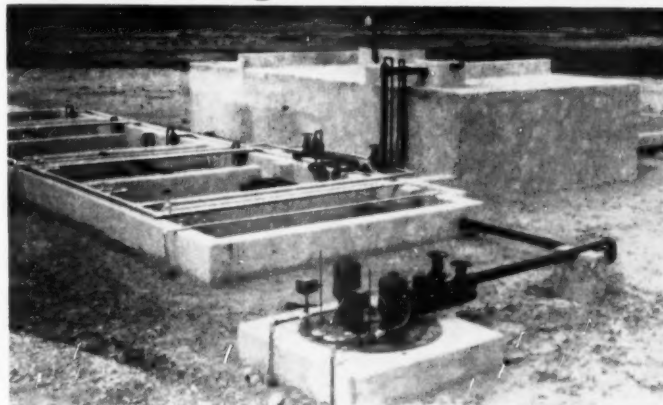
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ices will supply sewer repair personnel with extra vehicles if necessary. Warden services will report breaks, leaks and stoppages they find in the sewer system. Police services will guard important structures and facilities, and issue permits and passes for travel of sewage plant representatives and their repair crews. The sewage works organizations must correlate its emergency repair operations with all these other civil defense groups to assure the success of the emergency operational program.

No one can predict accurately

the extent of damage to the sewage works that will occur from an enemy air attack or just what emergency repair procedures will have to be adopted to maintain the flow of sewage in sewer lines. As information concerning actual damage is made available, proper repair procedures must be instituted. The skill and ingenuity of the regular maintenance crews must be relied on heavily in making these repairs quickly and effectively.

A damage survey report should be given to the local civil defense director at the control center. That

official would determine the priority for making repairs to the various utilities, enlist mutual aid and mobile support if additional assistance is considered necessary, and order the various engineering services into action. The damage report should include: (a) An estimate of the number of breaks in the sewer lines; (b) An estimate of the length of pipe that must be replaced, and the sizes; (c) A list of needed repair equipment such as pumps, bulldozers, power shovels, trenchers, trucks and tools; (d) An estimate of construction materials and supplies needed for making the repairs; (e) A statement of the condition of the disaster site, noting the extent of flooding in basements and streets; (f) An estimate of the damage done to the sewage treatment plant if that part of the sewage works has been bombed, and an estimate of the equipment, materials and men needed to put the plant back into operation; (g) An estimate of the equipment, materials and labor needed to restore pumping stations; (h) A recommendation on the points where sewage could be discharged temporarily; and (i) An appraisal of the need for providing privies or latrines in the event sewage service cannot be restored quickly.

Repair Procedures

Sewers.—Generally, any repairs made to sewer lines would be permanent in nature. However, temporary repairs may be necessary where a sewer line or manhole must be replaced quickly to restore traffic on an important street or critical highway. Asbestos-cement pipe, wooden conduits, or some other type of quick-coupling pipe such as the Federally stockpiled 8-inch lightweight steel pipe, could be used to expedite such emergency repairs. Small diameter pipes might be replaced temporarily with bituminous-fibre pipe which also is easily and quickly coupled. Water and sewer lines may be repaired concurrently, although it might be necessary to reconstruct the sewer lines first to reduce the pollution hazard and expedite clean-up operations.

Repair of large diameter sewers requires much time and large amounts of construction materials. This work would be a function of the sewage works organization and would be carried out as quickly as conditions permitted.

Pumping Stations.—Where water

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is available but sewer repairs have not progressed to the point that full use can be made of the plumbing facilities, close cooperation must be established between the sewage works and the water utility officials to control the situation. The need for water in the area must be satisfied, but not to the extent of creating an extra burden for the sewage repair crews. The methods for accomplishing this should have been determined previously. The stand-by pumping and power generating equipment and the parts and supplies provided at the sewage pumping stations in the pre-disaster planning period should be placed in operation promptly, and necessary repairs completed without delay. As with sewer lines, the emergency restoration of a sewage pumping station will depend largely on the initiative and ingenuity of the repair crews. The important thing is to keep the sewage moving to prevent it from overflowing into streets and basements.

Treatment Plants.—Little information can be given that would be helpful in the actual repair of a damaged sewage treatment plant. Where sewage treatment plants are totally destroyed, the need for immediate restoration should be analyzed and a decision regarding replacement reached on the basis of the following considerations.

Some sewage treatment plants, such as those protecting public water supplies, shellfish layings, bathing places and streams used by dairy cattle, have a direct bearing on public health. Other sewage treatment plants are utilized to maintain the industrial quality of the stream water or solely for the purpose of nuisance abatement or prevention. Where plants of this type have been destroyed reconstruction might be subordinated to the more urgent construction needs of critical industries and military services when considering the replacement of a sewage plant.

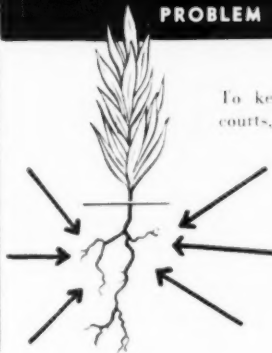
References

¹The Effects of Atomic Weapons. Department of Defense and Atomic Energy Commission, 1950, National Security Resources Board, Supt. Documents, U. S. Gov't. Printing Office, Washington 25, D. C.

A list of other appropriate booklets, manuals and guides can be obtained from the Washington office of the Federal Civil Defense Administration.

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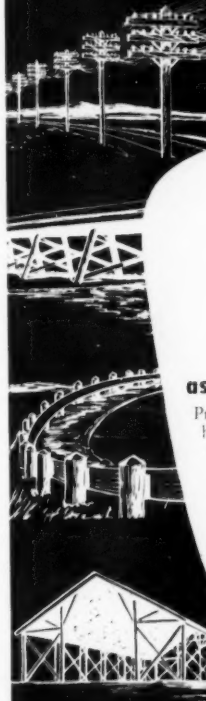
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**Eliminating Flies
At Garbage Receptacles**

Several California cities have been greatly plagued by flies, many of which they found were breeding in and around garbage and refuse receptacles. To limit this, El Centro requires the garbage collector to steam-clean all containers before returning them. During four months of the year when the flies are the worst, the city sprays every garbage and trash container once every 6 days. Two different insecticides are used alternatively so that the flies do not have a chance to become immune to either; one mixture being 50% chlordane, 18% DDT and 3% pyronone 20; the other being 30% toxaphene, 5% benzene hexachloride and 2% pyronone 20. The use of two mixtures alternating has been adopted by other California cities, but the mixtures are not all the same. Other mixtures used are 68% chlordane and DDT compounds, with sufficient pyrethrin for immediate knock-down qualities, mixed with five parts of diesel oil; another, 35% toxaphene and benzene hexachloride with pyronones. One city estimated a reduction of 90% of the flies in the city.

"Cities Report Successful Experience with Chemical Sprays for Fly Control," *Western City*, April.

**Treating Rendering
Plant Wastes**

Rendering and meat packing wastes receive primary treatment by fine screening, plain sedimentation, and pressure flotation. Secondary treatment (seldom required) is provided by biological filtration or activated sludge. Tanks for sedimentation should provide detention for at least 30 min. of peak flow. If recovery of waste fats is not an item, mechanical screening with a vibrating or rotary type fine mesh screen may be the most economical

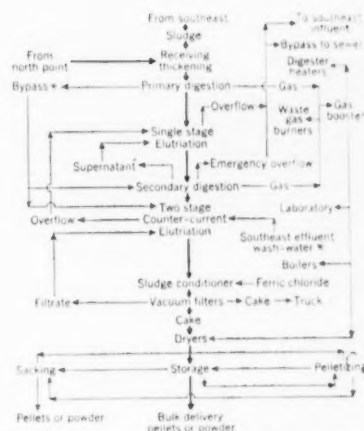
answer. Pressure flotation is the most efficient method of primary treatment for by-products recovery, pollution control and water conservation. All the wastes except manure and sanitary sewage are blended in a catch basin and flow into a process pump, air and coagulant being added in the suction line; thence they flow into a retention tank where undissolved air is liberated. Thence the flow enters the Flotator at atmospheric pressure, where the dissolved air is liberated, carrying solids to the surface, from which they are removed by skimming arms. By this process 93 to 99% of grease and suspended solids may be removed.

"The Why and How of Treating Rendering Plant Wastes," by L. S. Farrell, Mgr. Process Engineers. *Water & Sewage Works*, April.

**Sludge Processing
In San Francisco**

San Francisco's sewage receives primary treatment in three plants. The sludge from the North Point plant is pumped to the Southeast plant, where it is treated in combination with the sludge from that plant. The combined sludges are thickened by plain settling, and grease is skimmed off and mixed with the sludge, which is then pumped to digesters. The digested sludge is filtered on vacuum filters, the cake from which is dewatered by Combustion Engineering Co. flash dryers. It is possible to feed the dried sludge to storage, to a sacker, to a pelletizer or to bulk loading.

The pelletizing of dried sludge is a new process for sewage treatment, although this method has been used successfully for many years for processing food such as cattle feeds. Pelletizing equipment was installed to produce a more granular product and to reduce the dust. From present experience it is seen that it



Courtesy Civil Engineering

● **SLUDGE flow diagram at San Francisco's Southeast plant.**

is possible to pelletize dried sludge, but the dies wear out rapidly due to its gritty nature. Experiments are being conducted by the plant on the effect of moisture, and by the manufacturer to determine the proper material for the die and the effect of the shape of the openings. It will take considerable time before solutions to these problems are reached. Since January 1953 the dried sludge has been sold "as is" to a contractor on a short-term contract basis.

"Centralized Sludge Treatment Featured in San Francisco Sewage Plans," by Ben Benas, Sr. Civ. Engr., Sewage & Water Treatment Div. *Civil Engineering*, April.

**Land Disposal of
Sewage and Industrial Wastes**

The natural processes of soil filtration and aerobic biochemical stabilization achieved through soil bacteria and other organisms can produce a clarified, pathogen-free, fully oxidized fluid. The soil has great ability to oxidize rapidly many toxic and noxious organic and in-

organic wastes. Land disposal can be classified as: (1) irrigation of plants by the intermittent application of effluent to certain restricted crops, such as grasses or cotton; and (2) spreading within natural soil basins, beds or spreading fields by the intermittent application of effluents. Land disposal requires minimum plant investment. Aerobic environment is required for nuisance-free land disposal. Intermittent dosage may provide as much as 10 times the volume of gaseous oxygen that is present in a diluting water body. Design and operation-

al factors in land disposal are: (a) irrigation and spreading rates with different soils; (b) surface soil conditioning; (c) cropping; (d) cycles of effluent application; (e) effluent quality; (f) climate, and other variables. Highly mineralized industrial wastes and infiltrating sea water require separate disposal and may be unsatisfactory for simple irrigation or recharge of the underground aquifers.

"Land Disposal of Sewage and Industrial Wastes," by Ralph Stone. *Sewage and Industrial Wastes*, April.

Experiences with Garbage Grinders

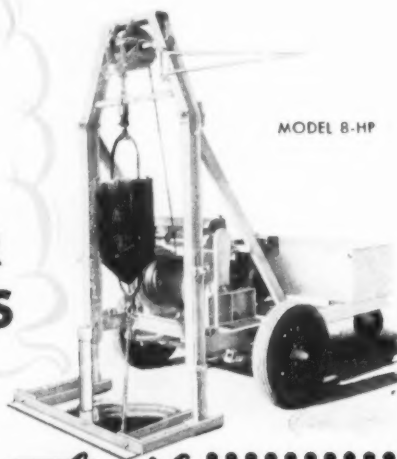
The use of garbage grinders in seven cities—Los Angeles (2,000,000 population, 80,000 grinders), Cleveland (915,000 population, 20,000 grinders), Oklahoma City (244,000 population, 4,000 grinders), Detroit (1,850,000 population, 20,000 grinders), Indianapolis (427,000 population, 4,500 grinders), Minneapolis (522,000 population, 5,000 grinders), and Washington, D. C. (800,000 population, 6,000 grinders), is reported to have had no measurable effect on refuse collection or sewage treatment. Los Angeles, with grinders used by about one-eighth of the families, is the only one noticing any effect; it finds a steadily reducing quantity of garbage collected, and that some of the heaviest ground garbage settles in the upper ends of some sewers laid on very flat grades.

"One Family in Eight Makes the Difference," *American City*, April.

Disposal of Garbage: By Grinding and Digesting

Richmond, Ind., since the spring of 1951 has been grinding its garbage and digesting it with sewage, the amount in 1952 averaging 207 tons per month, or 0.35 lb. per capita per day. The plan was adopted in connection with enlargement of the sewage treatment plant, for several reasons: 1—collection of garbage separate from the other refuse was already an established practice; 2—land suitable for land-fill was difficult to find and expensive; 3—grinding equipment for sewage screenings was familiar to the plant personnel, and its maintenance known to be low; 4—the additional gas derived from digestion of garbage would be useful for operating the activated sludge plant. "The results have been eminently satisfactory, both financially and esthetically." Digester capacity of 10 cu. ft. per capita was provided for combined sewage sludge and garbage. An apron feeder carries the garbage from a truck-filled hopper to a Jeffrey grinder, tin cans, bones, etc. being picked off the belt by hand. A "Jigrit" washer removes egg shells, bone chips, etc. from the ground slurry, which is pumped into the digestion tanks. The gas is utilized by three gas engines and for heating the digesters and buildings. The operating cost of garbage disposal in 1952 was: for operating grinder and conveyor, pumping to digesters, supervision and mainte-

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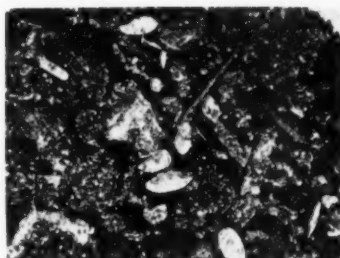
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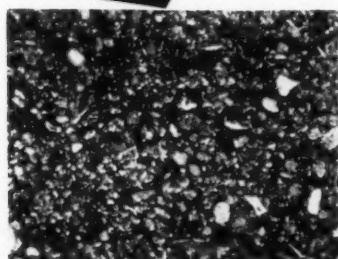
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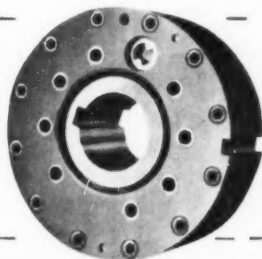
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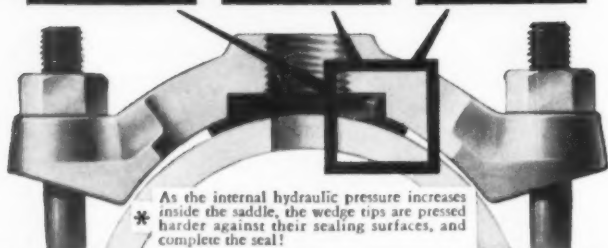
PIPE TO GASKET



GASKET TO SADDLE



SADDLE TO PIPE



* As the internal hydraulic pressure increases inside the saddle, the wedge tips are pressed harder against their sealing surfaces, and complete the seal!

A VELVET GLOVE FOR YOUR PIPE LINE! Only the most moderate tightening is needed on the ShurSeal Saddle. Merely tighten the nuts enough to prevent the saddle from shifting during the drilling operation, and your ShurSeal is made! Straps which are under less tension RESIST CORROSION BETTER. ShurSeal Saddle straps "hug" the pipe and eliminate bottom point pressure, insuring against crushing and breakage.

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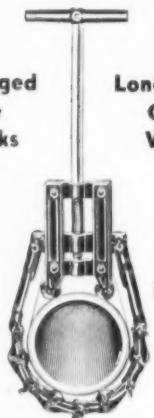
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With
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nance, and disposal of sludge on farms, \$4,286. Credit was taken for 8,080,000 cu. ft. of garbage gas at \$0.65 per 1,000 (the rate charged by the local gas company), and for receipts from farmers for the sludge delivered, of \$5,993; giving a profit of \$0.69 per ton of garbage. The construction cost properly chargeable to the garbage disposal portion of the plant is \$101,750.

"Garbage Grinding Pays Its Way," by W. E. Ross, Supt. of San. Dist., and S. L. Tolman, Jeffrey Mfg. Co. **PUBLIC WORKS**, May.

Heat Treating Of Garbage

Because of the recent increase in vesicular exanthema, which is almost wholly confined to farms feeding raw garbage and to centers where garbage-fed hogs are received, heat treatment of garbage to be used for hog food is now required by many states. There seems to be no special equipment available for cooking garbage, but the U. S. Dept. of Agriculture and Public Health service last fall issued a report suggesting equipment that can be used for wet steaming (introducing live steam into a vat of garbage); dry steaming (cooking in a double boiler, or steam jacketed kettle); or by pressure steaming. In either case, it is required that the garbage be heated throughout the mass to a minimum temperature of 145° F. for not less than 30 minutes. It is established that, to obtain this temperature in pieces of pork 3 in. thick, requires a temperature of 212° in a fluid consistency for 30 min. Longer than 30 min., or a temperature higher than 212° may reduce the food value of the garbage. Inedible materials, including bones, should be removed before cooking. "Equipment for Heat-Treating Garbage," **PUBLIC WORKS**, May.

Director of Public Works

The City of South San Francisco, California is seeking a Director to head a new Department of Public Works. He will develop a full time engineering department to design, supervise construction and maintain streets, parks, sewers, sewage disposal, etc. Present engineering work being done on fee basis. Salary from \$700 to \$800 per month. Applicant must be a registered engineer licensed to practice in California. For further data write Emmons McClung, City Manager, City Hall, South San Francisco, California.

A Study of Refuse Collection

A STUDY and analysis of refuse collection and disposal was inaugurated as a Sanitary Engineering Research Project by the University of California in 1950, and the results are being published in a series of bulletins. The first of these, recently published, deals with collection operations and disposal by landfill. "It is believed that it presents the first extensive analysis of refuse collection practice since the monumental work of Rudolph Hering and Samuel A. Greeley published in 1921, and dealing principally with the horsedrawn refuse collection wagons prevalent at that time."

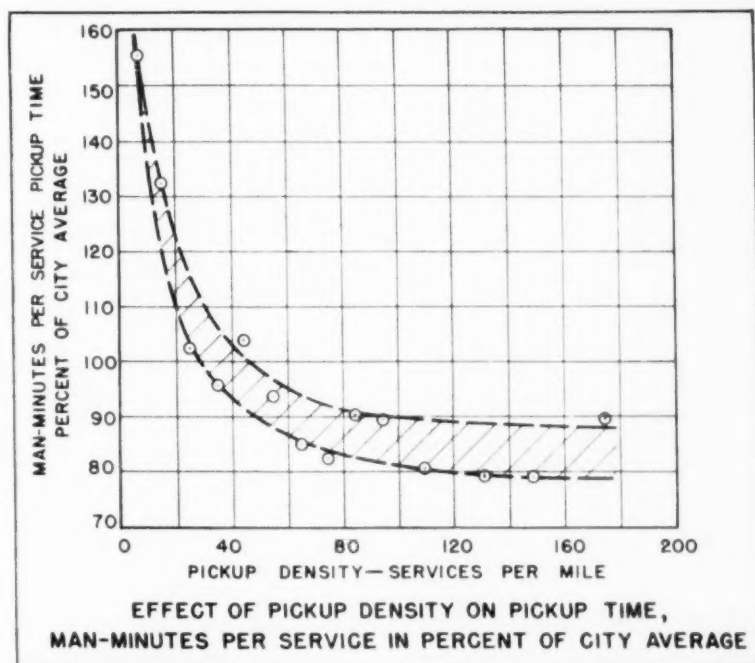
In collecting the data, actual on-the-spot investigations of quantities, distances, times, numbers of men and of vehicles, etc. were made in thirteen California cities, varying in population from 5,460 to 244,072. More than 200 refuse collection trips were accompanied by members of the staff.

In 3 cities, collection was by municipal force; in 3 by contract; and in the others there was municipal collection of domestic refuse and contract collection of commercial. They, therefore, were representative of California cities generally. But some conditions found in other states are not represented—severe winter conditions, for example. In only one of the 13 cities was there an appreciable amount of hilly service.

Four of the cities used only open-body trucks, of 3 to 21 cu. yd. capacity; the others used a few open-body trucks, but most were Gar Wood, Heil or Leach packers of 9 to 15 cu. yd. capacity. Rear-of-the-house pickup was practiced to a greater or less extent in 11 of the 13 cities—ranging from 26% to 100%.

per capita per day. In cities employing twice-a-week combined collection it averaged 48 lb., or 2.2 lb. per capita. The average total domestic and commercial refuse, including garbage, was 59.6 lb. per service per week. Twice-a-week collection generally results in greater quantities of refuse than once-a-week.

Labor Requirements.—Twice-per-week collection requires approximately 1.55 times as much manpower as once-per-week. Rear-of-the-house collection requires approximately 15% more manpower per ton in hilly, than in level urban areas. The use of multiple refuse containers, averaging 1.5 containers per service instead of only one, may



● PICKUP TIME shows little improvement for densities over 75 per mile.

the average of all cities being 61.9%. The round-trip haul from the city to disposal site ranged from 3.1 miles to 21.9 miles, averaging 10.7 miles.

From a study of these and numerous other data collected in the study, various findings and conclusions resulted, which are briefly summarized as follows:

Collection

Quantity.—The average quantity of garbage and domestic refuse collected in 8 cities employing combined refuse collection on a once-a-week basis was approximately 32 lb. per service per week, or 1.5 lb.

result in 8% increase in manpower required to pick up a ton. The approximate manpower required to load the refuse on the collection vehicle varied rather consistently from an average of 100 man-minutes per ton for 100% alley or curb collection, to 165 man-minutes for 100% rear-of-the-house collection. No significant difference was noted in the working pace or collection efficiency between municipal and private contract collection forces. There appeared to be no significant difference in the pickup time in man-minutes per ton between 2-man and 3-man collection crews.

Containers.—The use of standard

containers equipped with tight-fitting covers for the storage of garbage and domestic refuse is to be recommended, with the maximum size container for separate garbage storage and collection being 10 or 12 gallons; and for combined garbage and domestic refuse, approximately 30 gallons, with a weight limit when full of 65 lb.

Vehicles.—The study indicated that compaction-type vehicles were not being utilized to their potential capacity and, consequently, use of such vehicles required approximately 10% more manpower to pick up a unit of refuse than is required for open-body trucks. (This conclusion was based on a statistical analysis of 185 refuse collection trips with respect to labor requirements in man-minutes per ton, per yard, and per service.) It was observed that refuse collectors working with mechanical compaction-type trucks spent approximately 7% of the pickup time in waiting for either the truck or the compacting mechanism. In comparison, only 2% of the pickup time was spent in waiting for the open-body truck. It required approximately 20.4 man-minutes per ton for loading compaction-type trucks and 17.8 man-minutes for open-body trucks. The average unit weight of refuse collected by compaction vehicles was 440 lb. per cu. yd. compared to 323 lb. for that collected in open-body trucks; thus the actual hauling capacity of the compaction type vehicle is about 35 percent greater, for the same capacity than the open-body vehicles.

Pickup Time.—The average pickup time for the ten cities employing combined collection of garbage and domestic refuse was 145 man-minutes per ton, or 27.6 per cubic yard; or 2.38 per service; and that for collecting refuse alone was the same; with a standard deviation of the city averages of 23 man-minutes per ton for the former and 39 for the latter. These figures include the effect of all variables such as type of truck, number of collectors, percent of rear-of-house pickups and percent residential pickups.

Variations in the pickup density between 25 and 175 services per mile appear to have relatively little effect ($\pm 5\%$) on the pickup time in man-minutes per ton and per service. To pick up a ton of refuse, a pickup density of 10 services per mile requires 1.5 times as much manpower as a pickup density of 40 or more services per mile. The pickup of commercial refuse required

an average of approximately 130 man-minutes per ton compared to a ten-city average of 148 man-minutes for all types of collection.

Based on an average wage of \$1.50 per hour, the average labor cost of the pickup operation for all cities was \$3.71 per ton, and that of the total collection operation was \$5.37. The average distance traveled during the pickup operation was 4.4 miles per trip, ranging from 1.7 to 6.5.

Haul.—The average round trip haul distance of the 13 cities was 10.7 miles. The average total mileage per trip was 14.9. In combined collection, an average of 70.4% of the total trip time was devoted to the pickup operation; 19.8% to haul operation; 4.7% was spent at the disposal site; and 4.8% off the route. The labor requirement for the haul operation ranged from a low of 1.75 man-minutes per ton-mile for a 21.9-mile haul to a high of 7.65 man-minutes for a 7.8-mile haul; with an average of 4.0 for all cities. The truck speed averaged from 17 miles per hour for a total haul distance of 8 miles to 25 m.p.h. for a round trip haul distance of 22 miles.

The operation and maintenance costs of a $1\frac{1}{2}$ to 3-ton non-compacting refuse collection truck totaled

approximately 10 to 12 cents per mile; those of 2 to 4-ton mechanical packer trucks are estimated to be from 3 to 5 cents per mile more than for the non-compacting vehicle.

Health Considerations.—These require proper storage of refuse, particularly garbage, in satisfactory containers at the points of production. Objectionable odors are more closely related to sanitation practices of the householder than to frequency of collection. Twice per week collection is not particularly superior to once per week in the prevention of occasional odor nuisance. Collection frequency should be such that no significant fly problem results from fly breeding in the stored refuse.

Burning of refuse and hog feeding at a refuse dump are not desirable.

Disposal

Land Fill.—At five California cities employing the land fill method, the cost of operating varies from \$0.33 to \$1.57 per ton, averaging \$0.80.

Area requirements per 10,000 population vary from 5.7 acre-feet per year to 17.5 acre-feet, averaging 10.6.

Playground Equipment Needs Maintenance to Assure Safety

NORMAN R. MILLER

Vice President
American Playground Device Co.

BEFORE the playground season opens in the spring, the inspection, repair and repainting of swings, slides and other recreational apparatus should be completed. Timely repair and repainting will make equipment last longer and will provide a greater measure of child safety. A regular maintenance program should be continued throughout the year.

Badly worn, splintery or cracked slide siderails, swing seats, see-saw boards or other wood parts of apparatus are dangerous and should be repaired or replaced promptly. Swing chains, hooks, hangers and frame fittings should also be checked carefully. Worn slide chutes present a special problem. Few owners have the tools and equipment to do a proper job of slide chute repair or rebuilding. It is usually advisable to ship the worn chutes to the factory for rebuilding or to replace



● **FREQUENT INSPECTION, repair and repainting of playground equipment will make it last longer and assure maximum safety to the children.**

them with new chutes of all-steel construction.

Many park, school and playground systems are standardizing their apparatus to simplify replacement problems and to facilitate installation, repair and maintenance work.

The ratio of volume of refuse delivered to the site to volume in the completed fill ranged from 2.0 to 3.7, averaging 2.6.

A single bulldozer or dragline with operator should be able to operate trench fill disposal of 3,000 to 4,000 cu. yd. of refuse per year.

Sewer Service Charges in California

More than 60 California cities, with a combined population of more than 1¼ million, apply sewer service charges within the city limits; and 13 others charge only for connections to the city sewers outside city limits. Nineteen charge for outside connections substantially more than for those within the city—one ten times as much; 5 charge the same for both inside and outside. Another 19 permit no sewer connections outside the city. Substantial revenues are derived, Sacramento's reaching \$300,907 in the latest fiscal year, which averages \$2.19 per capita, and exceeded the expenditures by \$714. The revenues for the 75 cities range from less than 25¢ per capita to more than \$10; the average being approximately \$3.25 per capita. The maximum charge is in a town of 2,000 population where the sewage load is primarily industrial and the purpose is to obtain funds with which to extend the mains and construct an independent line for wastes. In most cases the revenues are used primarily for operation and maintenance of the sewerage system.

Of the 75 reporting cities, 54 use the flat rate exclusively; 2 base the charge on the water bill, 2 on the number of plumbing fixtures; others use number of rooms, size of water meters, or combination of flat rates and other methods. The charge to commercial users is based on the flat rate by 17 cities; on the amount of water used, by 24 cities. Five cities include BOD calculations in their industrial rate schedules. In one of these 5 cities, the industrial load from packing plants at the height of the packing season is 20 times greater than the entire domestic sewage load. The ordinances for three cities are unusual in that they provide for an over-all "sanitation" charge which includes not only sewer rental, but a special charge for refuse collection and disposal.

The above data are from an article, with tables, in the February issue of *Western City*.



8 (of 14) Climax 12 cylinder, 510 H.P. Gasoline Engines driving Peerless 48" Propeller Type Vertical Storm Water Pumps, each having a capacity of 45,000 GPM against a 28-ft. Head.

A NEW seven million dollar sewage disposal system, designed by and constructed under the supervision of Hubbell, Roth & Clark, Inc., Detroit, has recently been placed in operation for Saginaw, Michigan. Included in the system are five storm water pumping stations, two of which are equipped with a total of fourteen Peerless 48" propeller type vertical pumps, each having a rated capacity of 100 c.f.s. (45,000 GPM). All 14 are driven by Climax 12 cylinder, 510 H.P. gasoline engines. Reliable and independent power is provided as utility power failure is frequently caused by electrical and atmospheric disturbances associated with floods.



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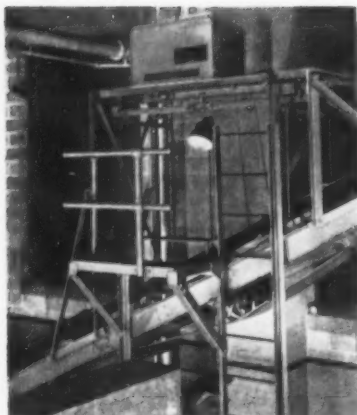
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Now's the time to mail this month's Readers' Service card.



● AS CAKE goes to the furnace it is weighed by a Transportometer.

Sludge Conveyor

(Continued from page 75)

is rated at 5000 lbs. per hour of cake with 70% moisture and 60% volatile matter. The sludge cake is progressively dried as it passes from hearth to hearth until it is burned, the third and hottest hearth operating at 1500°F. The furnace is equipped with oil burners to start and reach operating temperature,

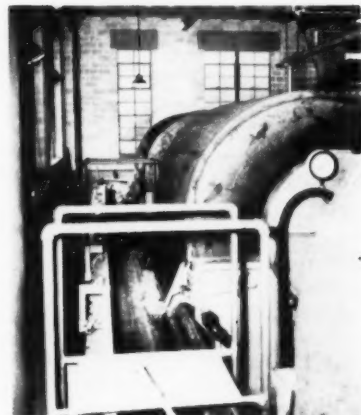
when the oil is shut off and the furnace operates entirely on filter cake as fuel. The ash is used for fill.

In the event that the furnace is inoperative, the sludge cake can be diverted in the chute at the furnace top to a 32-ft. Thermoid belt conveyor which carries the cake outside for discharge into trucks.

The wide variety of materials carried in pipes throughout the plant make it imperative that a quick method of identification be used. This problem is solved by a color code which shows at a glance what is conveyed by each pipe:

Light blue—	fuel oil
Dark blue—	city gas
Light green—	chlorine
Dark green—	110 volt current
Gray—	440 volt current
Buff—	city water
Aluminum—	heating
Dark red—	compressed air
Light red—	effluent water

A mercury switch actuated by a flowmeter controls the operation of the large effluent pumps automatically. All or part of the influent may be diverted from the plant by control valves ahead of the rag screens and grit chamber. Possible future additional chemical treatment



● VACUUM filters discharge dewatered sludge onto conveyor belt.

of the sewage has been provided for. The sludge can be pumped from any of the settling tanks to either of the two storage tanks or may be recirculated between the storage tanks.

The plant was built from plans prepared by H. K. Gatley, Consulting Engineer, Maplewood, N. J. The Westcott Construction Co. was the contractor. The conveyor system was designed and built by the Sy-Co Corp. of New York.

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THE WATER WORKS DIGEST

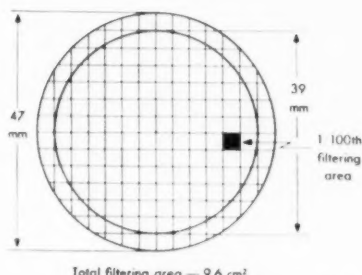
**Construction Equipment
Of Dallas Water Department**

At Dallas, Texas, ten thousand new homes are built each year and the water department has acquired a considerable amount of equipment to meet the resulting demands. The basic equipment is the repair truck; each is provided with a 60 cfm air compressor, pneumatic tamper, clay spade, pavement breaker, air-driven sump pump, air drill, and calking tools. Portable light plants, carryable Homelite 2500-watt generators. Other equipment includes earth boring machines, tapping machines, Dresser bell clamps, 19 pipe locators and leak detectors; ditchers, both ladder and wheel types; mobile crane; emergency chlorination unit; welding and metallizing equipment.

"Construction Equipment for a Modern Water Department," by Henry Graeser, Asst. Supt. and J. D. Henry, Supv. **PUBLIC WORKS**, May.

**The Millipore Filter
For Bacteriological Analysis**

A completely new bacteriological technique has been developed using the Millipore Filter, an outgrowth of the molecular or membrane filter. This material achieves filtration of microscopic and submicroscopic particles as a surface phenomenon, or a screening action, in which retention is defined by pores of controlled size. Application of this material involves an improved method of filtration, through its ability to concentrate bacteria quantitatively on a plane, and the resulting facility to culture, identify, and count bacteria retained on this plane. These filters will enable the bacteriologist in the water laboratory to make a more accurate analysis, and obtain the results in a very much shorter time, and at considerable saving in cost. The technique will facilitate the extension of control of water supplies to rural areas



Total filtering area — 9.6 cm²
Courtesy Water & Sewage Works
● THE Millipore filter disc, showing
dimensions

that are not adequately covered at the present time.

"New Bacteriological Technique for Testing Water and Sewage," by John H. Bush, Lovell Chemical Co. **Water & Sewage Works**, April.

**Sizing and
Maintenance of Meters**

Akron, O., since 1948 has pursued a program of resizing old meters, proper sizing and maintenance of new meters and services, and repairing and testing all meters larger than 1½ in. Services with meters larger than 1 in. are classed as non-domestic. Fire protection installations having a tight sprinkler system may use a detector check installation. Those having hose cabinets or fire hydrants require a meter of the compound type; the minimum charge on a fire service so metered is less than on a service metered with a detector check but the initial cost is considerably more; the customer can install either. Installations combining fire protection and nondomestic use require a fire service meter with a current-type bypass compound meter. Meters on nondomestic services are being resized where necessary, a "Meter Master" being used to check for correct size. (This meter is used also when complaints of large bills are received). When a 1½ or 2-in. meter needs to be overhauled, in-

stead of bringing the meter to the shop, a new chamber, disk, gear train and change gears for that particular size and make of meter are substituted for those of the customer's meter. Field tests of 1½ and 2-in. meters are run every 12-18 months, using a shop-tested 2-in. disk meter bypassed by a ¾ in. meter for small flows and connected to a rate-of-flow indicator.

"Sizing and Maintenance of Meters at Akron," by L. W. Bausher, Asst. Engr., Bureau of Water. **Journal, Am. W. W. Ass'n**, April.

**Using Activated Carbon
In the Slurry Form**

Chicago's South District Filtration Plant has for some time been developing the handling of powdered activated carbon in the slurry form. It now is proposed to use this method as the standard for the plant. They have been using 2 round steel slurry tanks, but the six additional mixing tanks are being made square of reinforced concrete because of the scarcity of steel plate. In the present tanks the carbon is unloaded on top of the water and allowed to become wet without agitation, which requires 2 to 5 days. In the new tanks high-speed agitation will be employed to maintain the slurry suspension. A tank full may last a week or more, and with this continuous use the agitating equipment wears rapidly. The cost of applying activated carbon will be much less when all of it can be handled in the slurry form.

"Operation of the Division of Water Purification—1952," by John R. Baylis, Engineer of Water Purification. **Pure Water**, February.

**Plastic Pipe
For Water Works**

Manufacturers of plastic pipe are said to have sold \$15,000,000 worth of such pipe in 1952. They have organized into a Thermoplastic Pipe

Division of the Society of the Plastics Industry; and 23 of them are sponsoring a research at the University of Michigan "to clear their pipe of all toxicity and taste and odor doubts in the minds of state health authorities." An effort also is being made to develop standards of threads, couplings, diameters, etc. A number of cities have used it experimentally in a few services; some being enthusiastic about it, others find it "promising". In one complete small distribution system (Pax, W. Va.), leakage has developed, believed to be due to surges in the

line causing pressures up to 210 psi, double the pressure for which it was sold. There are several materials used by plastic pipe manufacturers—polyethylene (used for most of the waterworks installations), butyrate, saran, styrene copolymers, and polyester pipe reinforced with glass fiber. In the University of Michigan research, the most aggressive known types of natural waters are used to determine whether they become toxic or insalubrious as a result of prolonged exposure to plastic pipe; also determination of the possible effects of

micro-organisms reputed to attack plastics.

"Plastic Pipe: What's Its Future?," *Engineering News-Record*, May 7.

Court Decisions on Fluoridation of Water Supplies

Based on five court decisions and other legal authorities, the authors state that the only possible conclusion is that, upon compliance with local law, there is no legal obstacle to adopting and carrying out a fluoridation program. For this reason, it would appear that the decision of a legislative body on the matter is controlling and that the desirability of initiating or continuing fluoridation of a public water supply can properly and usefully be argued only before the local governing body.

"Court Decisions on Municipal Water Fluoridation," by Walter W. Land and Edward K. Mosenthall, *Atty's Journal, Am. W. W. Ass'n*, April.

Well Water Containing Natural Fluoride

The Portsmouth, Va., water dept. serves four communities with a filtered surface supply. While they were planning to fluoridate it, a well was dug on the watershed which was found to contain 5 ppm fluoride. A well was drilled near the filter plant which can supply 2.5 mgd of water containing 5 ppm fluoride. By mixing this and the surface supply any desired fluoride content can be obtained. The installation cost \$30,000, which is more than the price of fluorine-feeding equipment. But it eliminates the need for purchasing fluoride, and pleases the consumers; also the additional well supply will overcome a water shortage during the summer months.

"Natural-Fluoride Well Water Added to Portsmouth Surface Supply," by X. D. Murden, Supt. Water Dept. *Journal, Am. W. W. Ass'n*, April.

Setting Meters in Spinach Fields

The U. S. Steel Corp. is building its Fairless plant on farm land, far from any city. It will employ 6,000 men, and it is estimated that their families and the necessary laundries, markets, garages and doctors and other professional men will produce a population of over 75,000. A town to be known as Levittown, Pa. has been laid out near the plant

Looking at it from any angle



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joint remains free-floating, flexible to compensate for vibration, expansion, contraction. This leak-free, trouble-free installation cuts maintenance costs.

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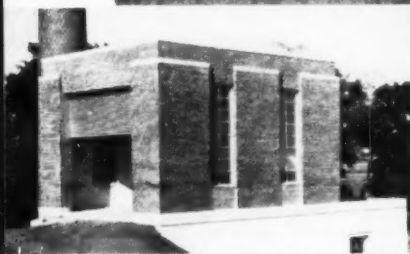
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 SEATTLE 550 Lane Street
 SANTA CLARA, CAL., 649 Alviso Road

and 16,000 homes are under construction there. The water distribution system to serve these is being constructed in spinach fields where only surveyors' stakes indicate the lines and grades of the streets to be built. The houses will have no cellars, and the water meters will be located about a foot inside the curb line. As the mains are laid, the services also are laid up to where the houses will be, ready for attachment to the plumbing. It seemed unwise, however, to set the meters before the street and sidewalk had been graded and constructed, so a

new procedure was adopted. Each meter will be set in a yoke, and in the preliminary work the two arms of the yoke are brought together and joined by a "frangible nut", so that water can be used through the yoke before the meter has been set. The frangible nut is a cast iron nut with a deeply recessed annular groove cut in the center of the outer perimeter. When the meter is to be set, the yoke valve is closed. A sharp blow on a chisel in the annular groove breaks the nut in two halves, which are removed and thrown away. Then the yoke ends

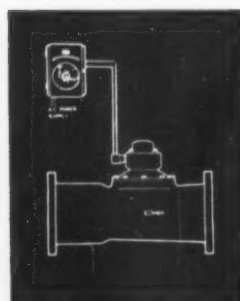
are separated and the yoke and meter inserted and the valve opened. Occasionally the temporary yoke is not found just where it should be. If the copper loop cannot be twisted where it belongs, the service is frozen with dry ice and alcohol and the loop placed where it should be. No curb box and stop are needed, as the yoke valve and meter box serve this purpose.

"16,000 Meter Settings in a Hurry," by Robert L. Hubbard. *PUBLIC WORKS*, May.

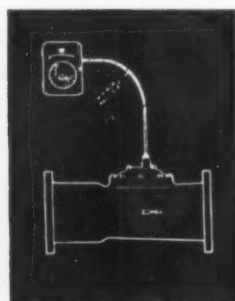
Water Fluoridation Pros and Cons

Articles by four authors appear in the April issue of the *Journal of the American Water Works Ass'n.*, two opposing the addition of fluorine to water supplies and two answering their arguments. George S. Bratton, of Anheuser-Busch, objects on the ground that the public water supply is used for a multitude of industrial and domestic purposes where fluorine is not needed and in some instances is actually harmful; citing especially the food and beverage industries. W. Victor Weir, Pres. St. Louis Water Co., answers that it is improbable that fluoridated water used in food or feed industries can contain more than 3 to 5 ppm; but feed producers accept mixtures containing 300-450 ppm and set a tolerance limit of 90-140 ppm. As for human food, beef contains 2 ppm fluorine; fresh mackerel more than 25 ppm. There would seem to be no reason for fearing harm from 1.0 ppm in the water ingested.

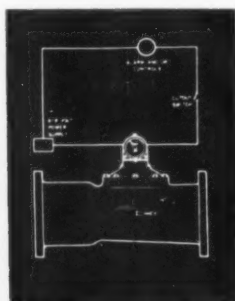
Jack E. McKee, Assoc. Prof. of San. Eng., Calif. Inst. of Technology, presented arguments in favor of using milk instead of water as a vehicle for fluoridation; that it would reach small towns and rural areas where there is no public water supply; that consumption of milk is more uniform than that of water throughout the year; it leaves the use of fluorine optional with consumers; the cost would be borne by those who use it. Commenting on this, Clair N. Sawyer, Prof. of San. Chemistry, M. I. T., said that the amount of fluorine added to the liquid should be under expert control, which it would be impracticable to apply to the great number of milk suppliers. Many whose children need the fluorine would be too poor or otherwise object to paying the additional cost. The food and drug laws present serious difficulties to the addition of fluorides to milk, which method has been proposed by some.



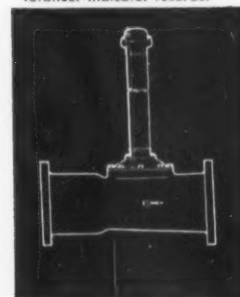
Electrically operated remote totalizer-indicator-recorder



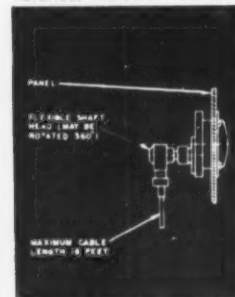
Flexible-shaft-operated remote totalizer-indicator-recorder



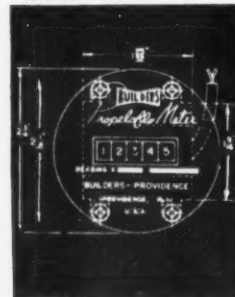
Propeloflo with electric alarm totalizer



Propeloflo with extended totalizer



Flexible-shaft-operated remote totalizer

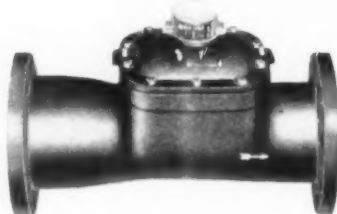


Electrically operated remote totalizer

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Isotopes for Locating Leaks

Scientists from England's Ministry of Supply's Atomic Energy Research Establishment are studying how radioactive isotopes can be used by industry. One of its latest studies was to devise a method of locating leaks in buried water mains. A preliminary test was made of a 1050-ft. length of 6-in. cast-iron main, in which a number of joints were deliberately loosened, but their number and locations unknown to the testing party. The section under test was first filled under pressure with a solution of sodium carbonate containing 30 mC of radioactive sodium (Na^{24}), which was diluted in the 1,250 gallons of water in the pipe.

Radioactive sodium, prepared by placing the compound itself inside the pipe for a few hours, is particularly suitable for tests of this kind, because its activity decays to one-half every 15 hours, so that after a short period the radioactivity in the water is reduced to a negligible level.

Two methods of testing were used. In the first, muddy water from around the joints was pumped to the surface of the ground and tested for activity. In the second method the active solution was moved along the pipe to another section and then a Geiger counter, mounted on the end of a probe, was put down crowbar-holes near the joints to detect residual activity which had leaked out with the water.

Three joints were loosened, but the tests showed that only two were leaking. This was confirmed afterwards by digging out the third joint that it had not been losing any water.

It is hoped to conduct further experiments to test the potentialities of the use of radio-isotopes for leak detection.

"Contractors Harness Isotopes in Search for Leaks in Main;" *Municipal Engineering* (England), April 3.

• • •

Machines Save Labor

WE REMOVED a mile of old cold mix resurfacing with a Caterpillar 12 grader equipped with a scarifier, requiring only 3 days. We windrowed it after loosening and loaded it for removal with a front-end loader. We also used a Standard Steel Works flusher to spray alleys with DDT to control insects.

We reduced the discharge line to 1-inch and used a fog type nozzle.—Bruce L. Gilmore, City Engineer, Columbus (9,000), Nebr.

SANITARY LANDFILL has been started for garbage and refuse disposal, using a crawler tractor equipped with a front-end loader. C. C. McCarthy, City Manager, Webster City (7800), Iowa.

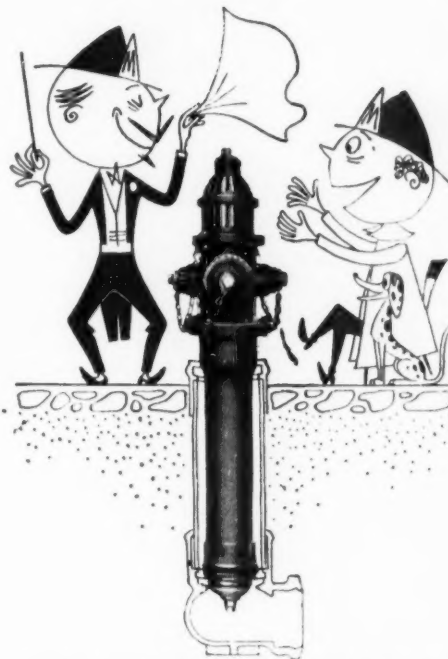
SNOW REMOVAL is a big job. We use trucks, motor graders, and loaders. We windrow the snow with graders, load with the loaders and

haul with the trucks. We use snow blades for quick removal, especially on airport runways. C. R. Black, City Engineer, Idaho Falls (23,000), Idaho.

OUR NEW Seaman pulvimixer cuts our asphalt mixing time in half as compared to the motor grader that we formerly used on this work.—A. J. Hull, Jr., City Manager, Laramie (16,000), Wyoming.

OUR MOST USEFUL piece of equipment is our Hough Payloader. We can't operate without it. We do

All Working Parts Contained in Removable Barrel—New Barrel Installed in Jiffy



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- This exclusive Mathews feature eliminates any need for repair work on the job. A spare barrel can be inserted in a few minutes and the broken barrel repaired in the shop.

- With automobile accidents breaking an increasing number of hydrants, this speed of replacement is of tremendous importance in maintaining community fire protection.

No Other Hydrant Offers So Many Essential Features

Compression type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle sections easily raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • All working parts contained in removable barrel • A modern barrel makes an old Mathews good as new • Available with mechanical-joint pipe connections

150th
anniversary

quite a bit of work on our long-range construction program, using an Austin-Western grader and a Seaman pulvimixer on road-mix jobs. We also use the grader and the mixer on reclaiming of old broken-up oil mats.—John R. Birch, City Engineer, Whitewater (5101), Wisc.

MOST INTERESTING job was laying 400 ft. of 36-inch concrete pipe at an average depth of 8.5 ft., using a ¾-yd. Michigan crane with backhoe.—K. R. McGahee, City Engineer, Suffolk (12,339), Va.

TWO MEN AND the operator made quick work of erecting a pre-fabricated service building with a simple crane attachment on a truck.—Warren W. Parks, City Manager, Indian Hill (2190), Ohio.

A **FORD TRACTOR** with Sherman backhoe and Wagner loader was used to great advantage to lower costs and speed up work on installation of service connections, loading surplus excavated material, and handling construction materials.—W. T. Cox, City Manager, Ashboro (8,000), N. C.

PUBLIC WORKS for June, 1953

FOR LOADING LEAVES during the fall months, we used an Athey force feed loader. This unit was very effective when the leaves were wet and heavy. Vacuum type loaders are used when the leaves are dry. James K. MacLeod, Public Works Director, Bangor (31,417), Maine.

WE HAVE OUR own 10,000-gallon bituminous storage tank, tank car heater and distributor for street work. Equipment includes a power grader for road-mix, grading, ditching and snow removal; and a 4-wheel drive truck used only for snow removal. George T. Anderson, City Engineer, Moorhead (15,000), Minn.

THE CITY BOUGHT a new Ford tractor with hydraulic front-end loader attachment, and also a crane attachment. This unit is most useful for loading asphalt patch material, gravel and dirt. Crane attachment is most useful for setting fire hydrants and poles up to 35 ft. long for the electric department. Another useful piece of equipment is a chat spreader that fits a standard gravel truck and is used for surface treatment. With our combination of equipment, the city can surface 4 to 5 miles of streets a year. Glynn Mills, City Administrator, Centralia (2500), Mo.

WE USED a well-point system most effectively for dewatering a deep sewer line which needed repairs. C. E. Swank, City Manager, Charleston (5501), Mo.

MOST EFFICIENT EQUIPMENT: Huber grader and roller, aggregate spreaders; five 3-ton Chevrolet trucks, a Hough loader, a Gravelly mower and Carter sludge pumps. S. R. Pursel, Town Engineer, Phillipsburg (20,000), N. J.

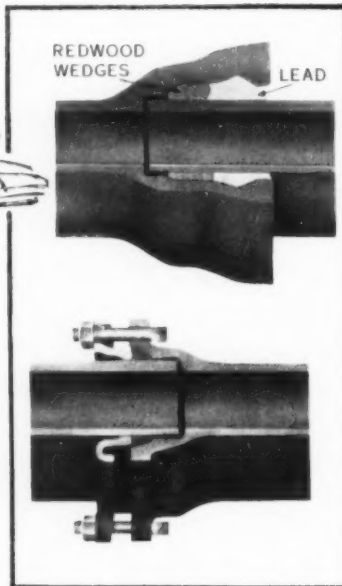
WE USED a ½-yd. Lorain backhoe to complete 3300 ft. of 48-inch reinforced concrete pipe storm sewer where we had an average 16-ft. cut to the invert of the sewer. Lawrence A. Fletcher, Ass't. Director of Public Works, Jamestown (47,900), N. Y.

80 - TON HYDRAULIC jacks were used effectively in jacking a 36-inch reinforced concrete pipe under the double tracks of the N. Y. Central RR. about 36 ft. O. Hagerman, Supt. of Streets, Medina (6400), N. Y.

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Salt Lake City Smith Tower Bldg.
Seattle, Wash.

Up Front for Adequate Roads

(Continued from page 14)

businesses to express satisfaction with changes from two-way to one-way operation and to encourage the city to increase the number of one-way streets. By the way, the cover of this issue of the magazine has a fine picture of the famous four-level interchange which is the heart of the Los Angeles Metropolitan Freeway System. As far as we know, this structure is unique in this country.

Asphalt Mixtures—In the March issue of the Journal published by the National Crushed Stone Association we noticed a little item in an article by A. T. Goldbeck, Engineering Director of the Association. The item relates to a new approach for determining the asphalt content of a finished asphaltic mixture. The method, which is in the development stage, depends upon the measurement of the solid volume of a sample of loose mix. With the volume and weight of the sample known, the density may be computed. This density may be compared with that of a mix of known asphalt content; any difference indicates a difference in asphalt content. Two methods have been studied for determining the required solid volume. One is by water displacement after removing entrapped air bubbles, and the other is by the use of a pressure meter, such as used in measuring entrained air in a fresh concrete mixture.

Tractor Attachments—American construction equipment manufacturers are not a group to let any grass grow under their feet; apparently there is no end to the flood of new and improved items which these people can turn out. We've particularly noticed lately some of the newer tractor attachments. For example, a number of companies, including Jaeger, Caterpillar, American Tractor, and Wagner, have new or improved tractor-mounted shovels on the market. The Danuser Machine Co. of Fulton, Missouri has a really ingenious combined fence-post driver and pavement breaker available, while Buda has a new portable earth drill. A new approach to a perplexing problem is that used by the R. C. Coolsaet Construction Company, Dearborn, Michigan in mounting a battery of six drills on a tractor to simplify the removal of strips of concrete pavement to reach underlying utilities. And have you noticed

that the Electro-Level Corporation of Sebastopol, California, is producing an electrical device which indicates the level (or angle) of a grader blade automatically? An operator shouldn't have much trouble meeting the usual grading tolerances with a gadget like that on his rig.

Prestressed Concrete—Seems as though interest in prestressed concrete is mounting steadily in this country. It has been and is being used for both large and small bridges under a variety of conditions. Maybe somebody will build a

prestressed concrete road in the U. S. soon; or has somebody already done so? Maybe another time there will be enough space left to write a little more along this line. It's a mighty interesting subject.

From Here and There—The Massachusetts Institute of Technology will hold a three-day professional conference on "Modern Highways" on June 23-25. Principal topics to be discussed include Planning, Surveys and Design. Technical Development Report No. 194 issued by the C.A.A. Technical Center at Indianapolis indicates that modifications have been



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made in the radioactive probes used for the field measurement of soil moisture and density; average precision for the moisture probe is 0.8 pound of water per cubic foot of soil and 3.0 pounds per cubic foot for the density probe. During the last six months of 1952 the New York City Transit System carried over one billion revenue passengers and lost about \$19.5 million dollars in the process. The maintenance cost index rose to 222.4 in 1951, as compared to 202 in 1950; the base value of 100 relates to 1935.

Doc Symons

(Continued from page 18)

sioners of East Orange, N. J.—That's the job Roswell Roper held until he retired.

—“Johnny” Johnson has resigned as Gen. Mgr. of the Buffalo Sewer Authority to become V. P. and Gen. Mgr. of the Brunner Asphalt Co. of Buffalo.

—Relly Clark has resigned as Supt. of Water at Avon, N. Y., to head up the Water Works Sales Div. of Haverstick and Co. of Rochester, N. Y.

—Dave Auld has replaced the late Harold Kemp as Director of San. Engr. of the District of Columbia and Ralph Fuhrman has been made Asst. Dir.

★ ★ ★

Hats Off To — Arthur Richards, retiring Village Engineer of Larchmont, N. Y. Arthur's yeoman work in developing a series of reports on a county water supply for Westchester County came in for some high praise at a dinner in his honor held by the Westchester Water Works Conference on April 23.—“Bill” Jiannott of the Thornwood Water District and “Al” Kassay, Supt. of Water and Sewage at North Tarrytown were co-presiders, or co-toastmasters, or co-something-or-other, much to the amusement of the 95 members and friends attending. Art was his usual humorous self.

—W. D. (Hap) Hatfield, my old boss, of the Decatur (Ill.) Sanitary District, who has received the only unlimited Grade I Sewage Works Operators Certificate in the State of Illinois, to date.

—Luther Fawcett, Chief Engr. of the Mahoning Valley Sanitary Dist. in Ohio, who has been cited by the Ohio Soc. of Prof. Engrs. for achievements in the field of engineering.

(More on next page)

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From W. A. (Bill) O'Leary, Design
Engr. of the N. Y. Bureau of Sew-
age Disposal. The first one you all
know, and the others are also from
"Bill's" World War II experience as
a San. Engr. in the U. S. Navy—
—Snafu—Situation Normal, All
Fouled Up
—Tarfu—Things Are Really
Fouled Up
—Fubar—Fouled Up Beyond
All Recognition

★ ★ ★

Purely Personal — About the time
that you read this, I'll be com-
fortably (?) ensconced in a hospi-
tal bed for ten days or so.—A
little matter of a dozen tests, x-rays,
fluoroscopes, etc. to chart the prog-
ress of my pet diverticula and to
observe my cardia-spasms in action
as well as to undergo what is
euphemistically called "repair sur-
gery."

If you have a little time and two
cents for a post card, drop me a note
at the New Rochelle Hospital, New
Rochelle, N. Y. some time between
June 15 and 20.—Thanx!

★ ★ ★

News Notes From Brushy Bend—On
Thursday April 30, the Penna. Wat.
Wks. Oper. Assn. held a spring sec-
tional meeting at Beaver Run with
a luncheon by the North Apollo
Firemans Assn.—The morning
session was an inspection of the
West Moreland County Water Au-
thority Plant; (that's one of "Spike"
Aldrich's plants of Amer. Wat. Wks.
Co.), and the "Post Prandial Pro-
gram" had Martin Flentje and Jack
Hamilton telling about the plant op-
eration.

—On June 4, the Pa. Wat. Wks.
Oper. Assn. held another spring
sectional meeting at Chester, Pa.
with "Ken" Armstrong, Chester
Water Supt., telling his operating
experiences. A "Turbidity Seminar"
was held at 5 P. M. in the "Pipe
Gallery" of the Hotel Oxford, and
"Deac" Matter of the Pa. Health
Dept. presided at the dinner, after-
wards.

—The Ohio Section (AWWA)
Districts were active in April with
the Northeast Dist. meeting at Avon
Lake on April 8; the N. W. Dist.
at Celina on April 15; and the S. W.
Dist. at Greenville on April 22.
—The Westchester Water Works
Conference will hold its annual
meeting in May after the AWWA
meeting in Grand Rapids.

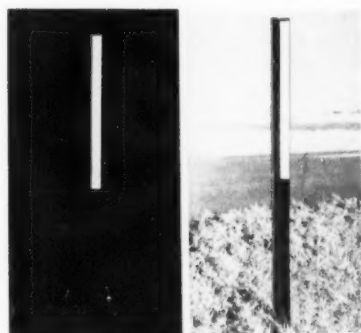
V. T. Y.—Doc Symons



Public Works

EQUIPMENT

NEWS



Splash-proof marker

Reflectorized Splash-Proof Stake Marker

A specially designed baffle guard protects this reflectorized stake from rain, mud or snow splashes, so that it retains its brightness under service. One of these stakes installed 10 ft. from the pavement edge was "200 percent brighter" than an unprotected marker. The stake is 8 ft. long, of galvanized steel, with silver reflective sheeting. Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

Use Coupon on page 32; circle No. 6-1

Tree Puller Operates on Most Any Tractor

This tree puller will operate on any tractor that has a 3-point hydraulic implement hitch. Roots are removed as well as the tree. On small tractors, trees up to 6 ins. in diameter can be removed, and at the rate of about one per minute. The tree is tipped away from the tractor for greater operator safety. Weighs 80 pounds and is easily attached or removed. Continental Mfg. Co., Kilgore, Texas.

Use coupon on page 32; circle No. 6-2

Cleaner for Zeolite and Resin Water Softeners

Zeotone is used to clean and "tone up" the zeolite or resin bed in commercial or industrial water softeners. It loosens iron deposits, silt and other material trapped in the softener bed. From $\frac{1}{4}$ to 1 lb. per cubic ft. of zeolite or resin is needed. No special precautions are necessary in handling the material since it is harmless to the skin. Booklet from Calgon, Inc., Pittsburgh 30, Pa.

Use coupon on page 32; circle No. 6-3

Cleaning, Melting and Pouring Equipment for Joints

The first step in sealing a joint or crack is removal of the old material. The RC joint cleaning machine



Improving joints

not only removes the old seal, but cuts a new face on joint walls to insure a perfect bond with the new seal. The JC power brush removes loose material from the joints and cracks. Special wire brushes are used. The 165 heating kettle will handle joint materials, even those containing rubber. And there are three models of pouring machines which maintain correct temperatures and do a neat job of filling. Joint Equipment Co., Box 67, Scarsdale, N. Y.

Use coupon on page 32; circle No. 6-4

Low Cost Air Entraining Agent Easy to Use

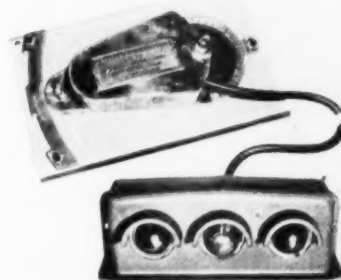
Mearlerete P is a reaction product of hydrolized proteins with other chemical additives. Foamed cement paste made with Mearlerete P sets to a solid foam and is used to produce concrete (density as low as 12 cu. ft.) and mortar, rigid thermal insulation, and light weight building products. A technical bulletin tells lots about it. Mearl Manufacturing Corp., 153 Waverly Place, New York 14, N. Y.

Use coupon on page 32; circle No. 6-5

Electric Level for Graders & Other Equipment

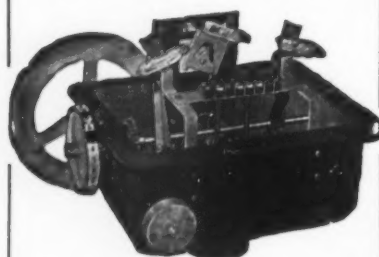
It is said that this electronic level device permits even unskilled operators of motor graders to grade within an eighth of an inch accuracy. In operation, a light panel instantly records any change in elevation by blinking three lights, permitting immediate correction or adjustment. The level consists of two units, the protractor level head and the lighthouse. Electro-Level Corp., Sebastopol, Calif.

Use coupon on page 32; circle No. 6-6



For level grading

ROTO-TROL



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Puts that second pump to work.

A 2-pump RF-2 ROTO-TROL with a built-in ALTO-TROL will operate each pump on alternate starting cycles, assuring equal use and wear of both pumps. Operates both pumps when required. Depth Indicator optional — extra.

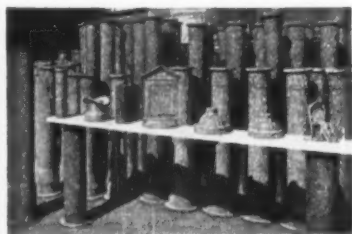
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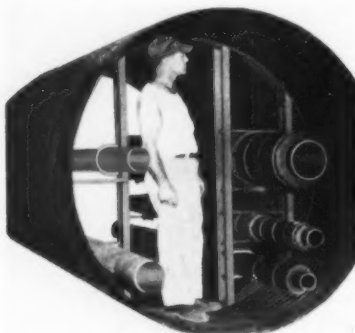
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For underground piping

ins.; ample walk-through space in larger sizes. Heavy-gauge, protected housing. Ask for Form 5210, Ricwil Co., Union Commerce Bldg., Cleveland 14, Ohio.

Use coupon on page 32; circle No. 6-7

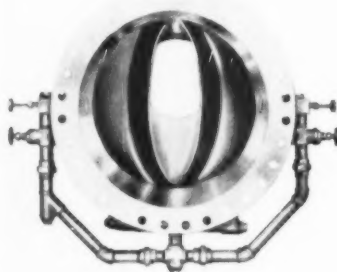
Portable Melting Pots for Sewer Joint Compound

Melting pots for sewer joint compound are available from Aeroil in 15, 25 and 50-gallon capacities for handling any of the sewer joint compounds. They are highly portable and can be equipped with kerosene burners, or with burners using bottled gas. Full data from Aeroil Products Co., Inc., Wesley St., South Hackensack, N. J.

Use coupon on page 32; circle No. 6-8

Self-Scouring Venturi Tube for Special Problems

Designed to solve the problems of accurate measurement of sewage,



Self-Scouring Venturi

PUBLIC WORKS for June, 1953

sludge, industrial wastes under low pressure conditions, this new venturi tube has an elliptical throat. The design permits a horizontal invert or a flat and straight bottom that is self-scouring of all sediment. Other factors are covered in data available from Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia 42, Pa.

Use coupon on page 32; circle No. 6-9

• • •

One-Man Chain Saw for High-Speed Work

The new McCulloch Model 4-30 chain saw is intended for high-speed felling and bucking of trees. It weighs only 30 pounds, but blades are available up to 36 ins. long; also a 15-inch bow saw. The saw has



One-man chain saw

automatic clutch, positive chain oiler and well-grouped engine controls. More data from McCulloch Motors Corp., Los Angeles 45, Calif.

Use coupon on page 32; circle No. 6-10

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Conditions Seedbed, Sows Seed and Rolls

vice now does almost the entire job of conditioning the seedbed, sowing the seed and rolling it in, all in a single trip. Especially good for park and roadside work because it greatly reduces hand labor and time requirements. Attaches to landscape tractors with same hitch that is used for scrapers and discs. Brillion Iron Works, Inc., Brillion, Wis.

Use coupon on page 32; circle No. 6-11

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Septic Tank and Cesspool Liquefier

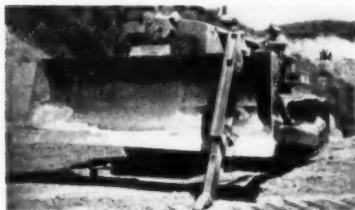
This is a powder which is designed to liquefy and destroy the waste matter in septic tanks and cesspools; and, in addition, it contains two deodorizing agents. One pound is said to be sufficient for 1000 gals. cesspool capacity, when poured directly into the drain, toilet, tank or pit. It is claimed to be

harmless to humans, animals, porcelain and plumbing. Ask for data on Rid-X, d-Con Co., 112 E. Walton St., Chicago 11, Ill.

Use coupon on page 32; circle No. 6-12

Ripper for Caterpillar Tractor Bulldozer Blades

A new type of ripper for Caterpillar Tractor bulldozer blades clamps onto the front of the 8S and 7S blades and can be adjusted to rip to depths of 22, 15 or 8 inches, or can be fully retracted. One or two units may be used on the same blade. The unit weighs about 650 pounds; the tooth is replaceable.



Bulldozer blade and ripper

The device is especially effective for confined dozing under rough conditions, for steep downhill work, for bank-sloping and for pavement breaking, either concrete or black-top. Shaw Co., 816 W. 5th St., Los Angeles 17, Calif.

Use coupon on page 32; circle No. 6-13

Hydraulic Tractor Loader Has Many Advantages

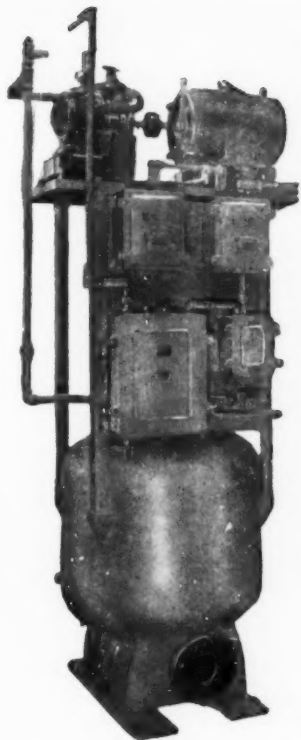
Balance, maneuverability and speed have been combined in this new Jaeger hydraulic tractor loader. These are available in 12 cu. ft.,



Hydraulic tractor loader

5 $\frac{1}{8}$ -yd., 1-yd. and 1 $\frac{1}{2}$ -yd. sizes. The largest unit has 4-wheel drive. The 1-yd. unit, for instance, has a static load capacity of 5,000 lbs., ability to turn in a 14-ft. radius and hoist its bucket more than 8 ft. high in 9 seconds, and forward speeds up to 18.7 mph. All load is centered on the front wheels. Engine is 55 hp. gasoline or diesel. More from Jaeger Machine Co., Columbus 16, O.

Use coupon on page 32; circle No. 6-14



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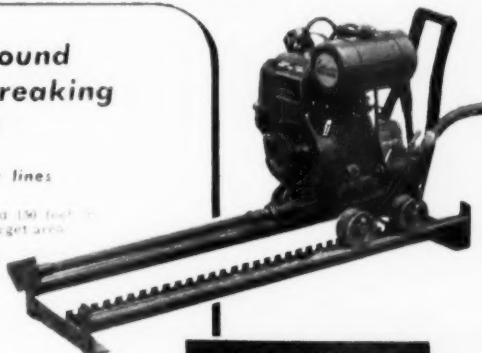
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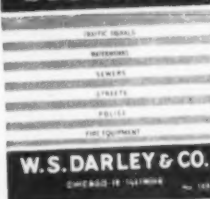
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Gray Iron and Semi-Steel Castings
SOUTH BEND 23, INDIANA

PUBLIC WORKS for June, 1953

Lead Melting Furnaces Use Kerosene or Bottled Gas

Heavy duty lead melting furnaces are available with either kerosene or bottled gas burning units, and in capacities of 200, 450 and 850 pounds. The lead can be melted in from 8 to 35 minutes, depending on size and other factors. High portability makes them fine for pipe line jobs where frequent moving is necessary. Full data from Aeroil Products Co., Inc., Wesley St., South Hackensack, N. J.

Use coupon on page 32; circle No. 6-15

Fluoridizer is Compact and Accurate, with Wide Range

Especially suited for small plant installation, this fluoridizer is compact and accurate. It holds a 100-pound bag. Changes in feed rate are by micrometer adjustment. Accuracy is said to be 3 percent by weight over a 20 to 1 range. Automatic feed in proportion to flow can be provided through the use of a measuring device. Data on the Model 50 from Omega Machine Co., 345 Harris Ave., Providence, R. I.

Use coupon on page 32; circle No. 6-16

Automatic Garage Door Opener

This "Electronic Door Opener" is motivated by weatherproof magnetic discs buried in the driveway on opposite sides of the door. The door is opened as the vehicle approaches the discs. No dashboard controls are needed. Door remains open in case of mechanical or electrical failure but can be operated manually. Illustrated booklet from Automatic Electronic Engineering Co., 2207 E. North Ave., Milwaukee, Wis.

Use coupon on page 32; circle No. 6-17

Earth Auger Can Bore 30-inch Hole 6 Ft. Deep

The 2MG Mall earth auger is claimed to bore a hole 30 ins. deep in hard clay in less than one minute; and it has an extension which permits boring holes to 6 ft. deep. The auger comes in 6, 9 and 12-inch diameters. The engine is 5 hp. Weight is not given, but the manufacturers say one man can carry the unit easily. The engine can be used with other Mall tools. Mall Tool Co., 7725 S. Chicago Ave., Chicago 19, Ill.

Use coupon on page 32; circle No. 6-18

Gravimetric Chemical Feeder for Small Plants

A new small chemical feeder, Model GLW-0, delivers either powdered, granular or lump material



Omega gravimetric feeder

up to $\frac{3}{4}$ -inch size, at rates of from $\frac{1}{4}$ to 100 pounds per hour. Rate is set by a single dial without timing or sampling. Unit requires 26 x 33 inches floor space and 25 inches front and back for door clearance. Ask for Bulletin 30-K4 from Omega Machine Co., 345 Harris Ave., Providence, R. I.

Use coupon on page 32; circle No. 6-19

Direct Army Commission for Sanitary Engineers

Direct reserve commissions, with concurrent call to active duty, are now available for sanitary engineers and entomologists in the Medical Service Corps of the Army. These may be granted either to men now in the enlisted grades or to civilians. Authority is contained in AG letter AGPR-D(M)210.455 (1 May, 1953)GI, date 18 May, 1953, subject "Program for Appointment and Ordering to Active Duty of Company Grade Medical Service Corps Officers of the Army Reserve." Letters of inquiry may be addressed to your Army Area Headquarters or to Lt. Col. S. J. Weidenkopf, Preventive Medicine Division, Office of the Surgeon General, Department of the Army, Washington 25, D. C.

PERSONAL NEWS

Eichwald Associates is a newly formed consulting engineering firm with offices at 237 East 39th St., N. Y., and at New Haven, Conn. The new firm will handle structural, mechanical and sanitary engineering work. An interior design department is a special feature.

James J. Corbalis, Jr., has been

appointed Engineer-Director of the Sanitation Authority of Alexandria, Va. The Authority will arrange financing, construction and operation of sewers, pumping stations and sewage treatment plants.

M. J. Shelton, general manager and chief engineer of the La Mesa, Lemon Grove and Spring Valley Irrigation District, San Diego, Calif., has been made a member of the State Water Pollution Control Board. His place on the San Diego Regional Water Pollution Board has been filled by Paul Beerman, Di-

rector of the San Diego Water Department.

James H. Herendeen has joined the consulting engineering firm of Gannett Fleming Corddry and Carpenter of Harrisburg, Pa. Mr. Herendeen has been with the CAA and before that with the New York State Highway Department.

Herbert Eldridge has been appointed director of the Arkansas Highway Department. Previously, Mr. Eldridge was Chief Engineer for Planning of the Texas Highway Department.

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Triangle Brand Copper Sulphate economically controls microscopic organisms in water supply systems. These organisms can be eliminated by treatment of copper sulphate to the surface. Triangle Brand Copper Sulphate is made in large and small crystals for the water treatment field.

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CONTINENTAL
STEEL CORPORATION

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What does the Price Tag Say?

\$500,000 the
COST OF BLIND
DIGGING

Yes, for mere pennies a day you can have the satisfaction and security of knowing exactly where

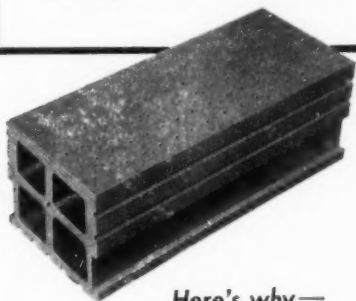
NOT-to-dig, — where pipes and cables are buried. Why take those unnecessary chances when the economical Detectron "505" gives you pin-point accuracy plus greater depth. There's nothing like a "505" Pipe Detector!

THE **Detectron** CO.

Write for Catalog No. 55

NORTH HOLLYWOOD, CALIF.

IT PAYS TO *Specify*
LEOPOLD
Glazed Tile
FILTER BOTTOMS



Here's why—

Permanent • No corrosion or tuberculation • Equal distribution • Low loss of head • Requires only small sized gravel • No metal in contact with water!

Write today for details

F. B. Leopold Co., Inc.
2413 W. Carson Street
Pittsburgh 4, Pa.

Worth Telling

by Arthur K. Akers

More on page 154

★ **BECKMAN INSTRUMENTS**, South Pasadena, Calif., transfers its New York office to its large new plant at Mountainside, N. J., near New York City. Dr. **ELDEN D. HALLER** has been appointed eastern sales manager with headquarters in Beckman's new Washington, D. C., offices.

★ **COMBUSTION ENGINEERING Inc.** is the new corporate name of Combustion Engineering-Superheater, Inc. of New York.

★ **WILLIAM W. KINGMAN** is new general sales and advertising manager of **HIGHWAY EQUIPMENT COMPANY**, Cedar Rapids, Iowa.

★ **J. H. TILLER** is now assistant sales manager, **THE GALION IRON WORKS & MANUFACTURING COMPANY**, Galion, Ohio, and **HAL J. MOODY**



Mr. Moody



Mr. Tiller

their district representative on motor graders and rollers in Arkansas, Alabama, Mississippi, and Louisiana. Headquarters, Little Rock.

★ **WILLIAM O. WILSON**, commercial vice president of **WORTHINGTON CORPORATION**, has retired after 53 years of service. He—and Worthington—have come a long way in those years. Now we hope he enjoys his laurels as much as he did his labors.

★ **RELLY S. CLARK**, formerly superintendent of water at Avon, N. Y., is now on the other side of the fence—as sales engineer, water works division, of **HAVERSTICH & COMPANY**, Rochester, N. Y.

★ **R. G. LeTOURNEAU INC.** has sold its earth-moving equipment business to **WESTINGHOUSE AIR BRAKE COMPANY**, including Peoria, Ill. and Toccoa Ga. plants. Henceforth they operate as **LeTOURNEAU-WESTINGHOUSE COMPANY**. We stand bareheaded before the \$19,500,000 purchase price, which included the interest in LeTourneau's Australian subsidiary.

FOR REPAIRING BELL AND SPIGOT JOINT LEAKS...

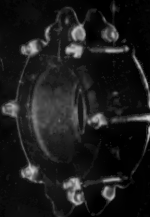


SKINNER-SEAL
Bell Joint Clamp for stopping bell and spigot joint leaks under pressure. Gasket is completely sealed: at bell face by Monel Metal Seal band — at spigot by hard vulcanized gasket tip. 2" to 42".

AND BROKEN MAINS

SKINNER-SEAL

Split Coupling Clamp. One man can install in 5 to 15 minutes. Gasket sealed by Monel band. Tested to 800 lbs. line pressure. A lasting repair. 2" to 24" incl.

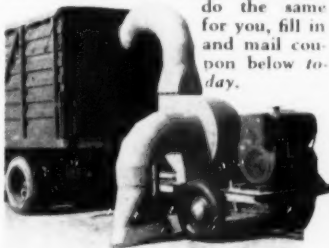


M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

**LEAVES
PICKED UP
in 1/2 the time
at 1/4 the cost**

That's the essence of a report from the Supt. of Public Works in a New York city.

To find out, without obligation, how an Elliott vacuum leaf loader can do the same for you, fill in and mail coupon below today.



M. A. ELLIOTTE

"SUCKER UPPER"

M. A. ELLIOTTE
5 State St., Troy, N. Y.

Please send today literature on street vacuum cleaners and loaders.

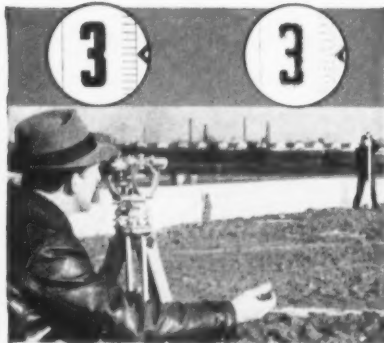
Name

Title

Address

Ask the man behind the "gun"

Coated optics
give you
this → not this →

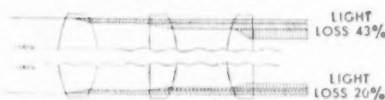


Model 3000, \$185.00*, complete with tripod.

with a White Universal Level-Transit

HERE'S what coated optics do for you. You can put in a full day without eyestrain or headache. There's less chance for a mis-reading. You get a clear, sharp sight — not a fuzzy image. What's more, you get your reading in far less time. Check this diagram. See for yourself how coated optics pass through up to 40% more light, provide a clearer image contrast.

PASSAGE OF LIGHT THROUGH UNCOATED LENSES



PASSAGE OF LIGHT THROUGH COATED LENSES

And there's more!

White Universal Level-Transits also offer you internal focusing, guarded vertical arc and ball bearing race which insures smooth operation, even in sub-zero temperatures. Check one out on your next trip. You'll soon be convinced a White can make your work faster, easier, more accurate. . . . Write for Bulletin 1053, DAVID WHITE Co., 399 W. Court Street, Milwaukee 12, Wisconsin.



Expert REPAIR
SERVICE on all
makes, all types
of instruments

*Prices subject to change without notice.

Worth Telling

by Arthur K. Akers



★ **NEVER UNDERESTIMATE** The responsiveness of **PUBLIC WORKS'** readers! In April we ran here an item telling of the inauguration of **CAPITAL AIRLINES'** New York-Grand Rapids direct flight. Imagine our gratification at the New York airport May 9 to find a phalanx of **BUILDERS** boys from Providence, fifteen strong and headed by **ROLLIE LEVEQUE**, who told us they had read our item then cancelled reservations elsewhere and bought fifteen roundtrips on Capital.

★ **KOEHRING COMPANY**, Milwaukee, appoints **E. J. HARTLEIN** (below) district representative for their Central-Northwest sales territory, succeeding **JACK MILLER**, retired. The **RAY C. CALL COMPANY**, Charleston, W. Va., assumes their distributorship for that state.



Mr. Hartlein



Mr. Dodson

★ **HOWARD W. DODSON** has been named vice president of the **LESS-MANN MANUFACTURING COMPANY** at Des Moines. They make a heavy-duty loader and expansion of operations is in the making.

★ **H. D. S. CHAFEE** has been appointed advertising manager of **BUILDERS - PROVIDENCE** and **OMEGA MACHINE COMPANY**, Providence. A young man of a distinguished line, we see no lessening here of the fine old New England influence in a f. o. n. e. firm.

★ **FRED OSBORNE** is elected a vice president of **UNITED STATES PIPE & FOUNDRY COMPANY**. He was previously president of the **Sloss-Sheffield Steel & Iron Division** of **U. S. Pipe**, in Birmingham.

★ **NATURAL RUBBER BUREAU**, of Washington, keeps branching out. This time into a 4-color full page ad. in the *Saturday Evening Post*. We at **PUBLIC WORKS** are happy to see added the *Post's* to our own monthly advertisements of **Natural Rubber**.

★ **TALKED OUT OF** adding 4 pages to this department for reproducing the **ALLIS-CHALMERS** pictures of high school prom parties at the company's West Allis, Wis. club house, we fall back on labeling it a fine illustration of how industry and community can work together.

★ **HOMELITE CORPORATION**, Port Chester, N. Y., has this string of new appointments: **E. W. McCLELLAN** as midwest regional manager, at 120½ S. Grove Ave., Elgin, Illinois. **FRANCIS DARROW**, manager of Buffalo district office. **TED SKROCH** goes from Grand Rapids to Indianapolis as district manager, with **HAROLD E. WIERSUM** succeeding him at Grand Rapids, while **JAMES W. THOMPSON** moves from Indianapolis to district manager, Charlotte, N. C.

★ **THE OSGOOD COMPANY** and the **GENERAL EXCAVATOR COMPANY**, Marion, Ohio, announce appointment of **GEORGE N. VOLZ** as division sales manager for the northwestern states **U. S. A.** and provinces of Canada.

★ **D. J. BYRD** is new division assistant manager, **GAR WOOD INDUSTRIES, Inc.**, Wayne, Mich.

★ **CHICAGO BRIDGE & IRON COMPANY** has elected **GEORGE S. SANGDAHL** a vice president. He will also manage their new sales office in the **Alcoa Building**, Pittsburgh.

★ **SMITH-BLAIR Inc.**, water works pipe clamps, pipe saddles, etc., of South San Francisco, have just opened this



new eastern warehouse and branch in Greensburg, Pa., to carry stocks and facilitate service. **AL. J. SLATTERY** is manager.

★ **JACK SERVICE** of **SPARLING METER COMPANY** gave us first American serial rights to this one at Grand Rapids the other day: A Kentucky road sign reads "Accidents don't prove who's right—they only prove who's left."

More on page 153

They all come back for more...

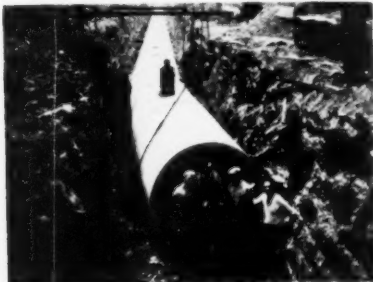
from

LOCK JOINT

36" Lock Joint Reinforced Concrete Cylinder Pipe being installed for Norfolk, Va.

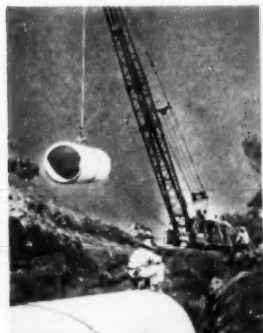


Laying 72" Lock Joint Reinforced Concrete Cylinder Pipe at Detroit, Mich.



YEAR AFTER YEAR satisfied customers turn and return to Lock Joint to solve their pressure pipe problems. The customers listed on this page have reordered Lock Joint Pipe from twice to more than forty times for the continuing construction of major water works installations . . . a total of nearly 1,500 miles of Lock Joint Pipe delivered on *reorders alone*. The variety of Lock Joint's designs makes the pipe suitable for any water works project requiring pressure pipe 16" in diameter or larger. Its low first cost, negligible maintenance charges, permanent high carrying capacity and unfailing service cause more and more water works officials to agree that "You can't go wrong with Lock Joint."

Laying 60" Lock Joint Reinforced Concrete Pressure Pipe for Tulsa, Okla.



Installation of 90" Lock Joint Reinforced Concrete Pressure Pipe for Denver, Colo.



SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains 16" in diameter or larger, as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

LOCK JOINT PIPE COMPANY

Established 1903

P. O. Box 269, East Orange, N. J.

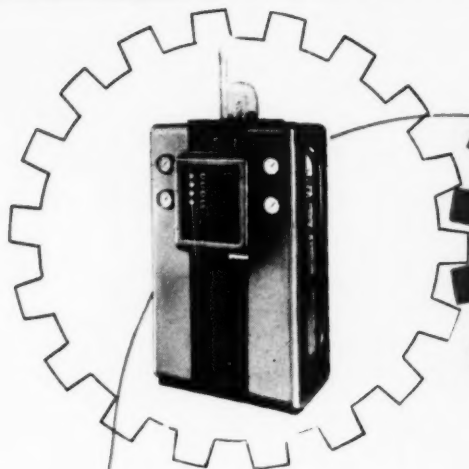
PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

SEWER & CULVERT PIPE PLANTS:

Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. • Kansas City, Mo. Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. • Oklahoma City, Okla. • Tulsa, Okla. • Beloit, Wis. • Hato Rey, P. R. • Caracas, Venezuela

Alexandria, Va. • Altus, Okla. Ashtabula, Ohio • Baltimore, Md. Bethlehem, Pa. • Birmingham, Ala. Boston, Mass. • Caracas, Venezuela Charlotte, N. C. • Chattanooga, Tenn. • Chicago, Ill. • Cleveland, Ohio • Cumberland, Md. • Denver, Colo. • Detroit, Mich. • Dominican Republic • E. St. Louis, Ill. • Flint, Mich. • Ft. Collins, Colo. • Greeley, Colo. • Greensburg, Pa. Harrisburg, Pa. • Hartford, Conn. Houston, Tex. • Huntington, W. Va. Huntsville, Ala. • Hyattsville, Md. Johnstown, Pa. • Kansas City, Mo. Little Rock, Ark. • Louisville, Ky. Maracaibo, Venezuela • Mobile, Ala. • Newark, N. J. • Newport News, Va. • New York City, N. Y. Norfolk, Va. • Paterson, N. J. Portland, Me. • Portsmouth, Va. Providence, R. I. • Pueblo, Colo. Richmond, Va. • Rochester, N. Y. Saginaw, Mich. • San Juan, Puerto Rico • Shreveport, La. • South Pittsburgh, Pa. • Syracuse, N. Y. Tennessee Valley Authority Toledo, Ohio • Trenton, N. J. Tulsa, Okla. • Washington, D. C. W. Palm Beach, Fla. • Wichita, Kan. • Wilmington, Del. Worcester, Mass.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE



DISINFECTION

Chlorine applied up-sewer to prevent septicity subsequently ensures better disinfection at the sewage plant—usually with an overall saving of chlorine.

CHLORINATION BY W&T *Geared* TO BETTER SEWAGE PLANT PERFORMANCE



SETTLING BASINS —

Chlorination keeps the sewage fresh and ensures continuance of proper settling in primary basin or Imhoff Tank.

TRICKLING FILTERS — Chlorine ahead of trickling filters on a programmed basis prevents septic odors and ponding — thus permitting biological oxidation to proceed normally.

ACTIVATED SLUDGE UNITS — Chlorination of the return activated sludge prevents bulking—and permits the activated sludge units to perform at maximum capacity.

Join the hundreds of sewage plants that are maintaining top performance of their treatment processes with chlorination — dependable, accurate chlorination by W&T.

**WALLACE & TIERNAN
COMPANY, INC.**

CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES